



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>





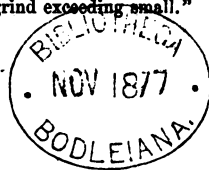


THE SCIENCE AND ART
OF
ARITHMETIC;
For the Use of Schools.

EXERCISE BOOK. PART I.

BY
A. SONNENSCHN
AND
H. A. NESBITT, M.A., UNIV. COLL., LONDON.

"The mills of God grind slowly, but they grind exceeding small."



LONDON:
WHITTAKER AND Co.
1877.

[All rights reserved.]

181 . 9 . 145 .



EXERCISE BOOK. PART I.

EXERCISE I.

(1)			(2)			(3)			(4)		
£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
5	4	2	5	3	4	7	6	10	7	8	11½
1	7	8	8	2	6	8	4	6	5	6	7½
(5)			(6)			(7)			(8)		
9	8	4	5	4	6½	7	2	3½	1	2	3
2	7	3	3	8	9½	8	4	2½	4	5	6
6	5	7	1	2	7½	5	7	6½	7	8	9
										4.	5
(9)			(10)			(11)			(12)		
1	3	5½	7	7	7½	3	7	4	7	6	5
5	8	9½	8	9	10½	6	4	8½	4	3	2½
7	5	3½		4	5½	4	9	2½	8	5	2
9	2	7	3	2	7	2	6	0½	9	6	9½
									2	3	8
(13)			(14)			(15)			(16)		
8	7	9¾	1	2	4½	6	2	4½	2	6	9¾
8	7	9¾	4	8	3	6	5	9½	3	7	11½
8	7	9¾	1	5	7¾	3	2	10½	4	8	10
8	7	9¾	5	7	7½	7	0	0¾	5	9	9½
8	7	9¾	9	1	7½	8	8	8	6	5	8

(17)

£.	s.	d.
3	6	4
3	8	8
6	6	7
2	6	6
9	4	1
7	9	9

(18)

£.	s.	d.
8	4	5
6	3	9
9	4	$10\frac{1}{4}$
7	6	$7\frac{1}{2}$
5	5	5
3	7	8

(19)

£.	s.	d.
1	2	$3\frac{1}{4}$
4	5	$6\frac{1}{2}$
7	8	9
9	6	$3\frac{3}{4}$
6	8	5
7	4	$1\frac{1}{2}$

(20)

£.	s.	d.
1	4	$6\frac{3}{4}$
9	6	$7\frac{1}{2}$
2	6	$8\frac{1}{4}$
6	8	$4\frac{1}{4}$
3	6	$9\frac{1}{4}$
2	7	0

(21)

4	7	$7\frac{1}{2}$
4	8	$11\frac{1}{2}$
2	5	$11\frac{1}{2}$
7	8	$9\frac{1}{4}$
6	6	$6\frac{1}{4}$
7	9	$5\frac{3}{4}$

(22)

7	6	$4\frac{3}{4}$
8	6	$3\frac{3}{4}$
5	9	$4\frac{1}{4}$
4	7	$11\frac{1}{2}$
5	8	$9\frac{1}{4}$
2	2	$1\frac{1}{2}$

(23)

2	7	8
5	9	3
4	2	11
7	8	4
6	2	1
1	0	6
3	9	10

(24)

3	1	$6\frac{1}{4}$
7	4	$5\frac{1}{2}$
2	7	$9\frac{3}{4}$
2	8	$10\frac{1}{4}$
9	0	$8\frac{1}{4}$
3	4	$11\frac{3}{4}$
1	6	$2\frac{3}{4}$

(25)

1	3	$9\frac{1}{2}$
2	7	$2\frac{3}{4}$
3	6	4
	8	$7\frac{1}{4}$
4	9	$1\frac{3}{4}$
6	9	$5\frac{1}{2}$
8	8	8

(26)

8	9	4
2	5	7
8	6	3
6	9	5
1	4	9
3	8	10
6	4	11

(27)

9	8	$7\frac{1}{2}$
6	5	$4\frac{1}{4}$
3	2	$1\frac{1}{2}$
1	4	$2\frac{1}{4}$
7	5	$8\frac{3}{4}$
3	8	$4\frac{1}{2}$
6	1	$5\frac{3}{4}$

(28)

6	7	$9\frac{1}{4}$
1	8	$10\frac{1}{4}$
2	9	$11\frac{1}{2}$
3	5	$4\frac{3}{4}$
9	7	$6\frac{3}{4}$
7	5	$9\frac{1}{4}$
8	7	$2\frac{1}{2}$

(29)

6	9	$11\frac{1}{4}$
4	9	$4\frac{1}{2}$
2	6	$6\frac{3}{4}$
3	9	$9\frac{3}{4}$
8	7	$2\frac{1}{2}$
8	9	$7\frac{3}{4}$
6	7	$5\frac{1}{2}$

(30)

8	1	2
7	3	4
6	5	9
6	5	4
3	2	1
3	7	8
2	1	11
1	4	10

(31)

5	7	8
3	8	$7\frac{1}{2}$
7	7	9
2	8	9
9	8	9
4	7	$5\frac{1}{4}$
5	9	4
8	8	3

(32)

8	7	$10\frac{1}{2}$
5	4	4
6	2	$2\frac{1}{4}$
7	9	9
7	7	$10\frac{3}{4}$
6	7	4
8	6	$5\frac{1}{2}$
4	3	$2\frac{1}{2}$

(33)

£.	s.	d.
1	9	$7\frac{1}{4}$
2	0	$8\frac{1}{2}$
3	1	$9\frac{3}{4}$
4	2	$10\frac{1}{4}$
5	3	$11\frac{1}{2}$
6	4	$1\frac{3}{4}$
7	5	$2\frac{1}{4}$
8	6	$3\frac{1}{2}$

(34)

£.	s.	d.
7	8	$7\frac{1}{2}$
7	9	9
6	0	4
5	0	3
9	9	8
7	6	3
2	2	$0\frac{1}{4}$
5	5	$7\frac{1}{2}$

(35)

£.	s.	d.
1	9	$10\frac{1}{4}$
4	8	$9\frac{1}{2}$
2	7	$11\frac{1}{4}$
3	8	$2\frac{1}{2}$
6	9	$8\frac{3}{4}$
8	7	$6\frac{3}{4}$
4	6	$7\frac{1}{4}$
7	5	3

(36)

£.	s.	d.
6	8	4
6	9	5
7	3	10
4	3	11
7	7	7
6	8	4
3	2	7
1	1	$1\frac{1}{4}$

(37)

5	5	3
7	6	$8\frac{1}{4}$
4	9	7
9	9	$4\frac{1}{4}$
2	3	5
6	0	$7\frac{1}{4}$
7	7	7
8	7	$7\frac{1}{4}$

(38)

4	7	$3\frac{1}{2}$
6	5	$9\frac{1}{4}$
8	8	$10\frac{3}{4}$
2	2	4
1	6	11
3	5	$5\frac{3}{4}$
5	9	$1\frac{1}{4}$
7	8	$2\frac{1}{2}$

(39)

1	2	$3\frac{1}{2}$
4	5	$6\frac{1}{2}$
7	8	$9\frac{1}{2}$
1	0	$11\frac{1}{4}$
1	2	$1\frac{3}{4}$
4	5	$6\frac{1}{4}$
5	6	$7\frac{1}{4}$
3	6	$9\frac{3}{4}$
7	6	$5\frac{3}{4}$

(40)

1	0	2
2	2	5
3	4	$8\frac{1}{2}$
4	6	11
5	8	4
6	0	7
7	2	$0\frac{1}{4}$
8	4	3
9	6	6

(41)

8	0	$10\frac{1}{2}$
7	0	$3\frac{1}{4}$
9	0	$5\frac{1}{2}$
6	0	$7\frac{1}{4}$
2	0	$8\frac{1}{2}$
2	0	$9\frac{1}{2}$
2	0	$6\frac{1}{4}$
3	0	$6\frac{3}{4}$
7	0	$2\frac{3}{4}$

(42)

6	5	$7\frac{1}{2}$
	5	$7\frac{1}{2}$
1	7	$5\frac{1}{4}$
7	6	11
	8	9
	4	$8\frac{1}{2}$
3	7	7
2	6	8
9	9	9

(43)

7	6	$5\frac{1}{2}$
8	8	$10\frac{1}{4}$
3	6	$11\frac{3}{4}$
6	8	$10\frac{1}{2}$
2	7	$11\frac{1}{4}$
9	7	$11\frac{3}{4}$
4	9	$9\frac{1}{2}$
1	4	$7\frac{1}{2}$
5	3	$6\frac{1}{4}$

(44)

9	9	$7\frac{1}{2}$
7	6	$4\frac{1}{4}$
3	7	$6\frac{1}{2}$
3	9	$7\frac{1}{2}$
6	2	$5\frac{1}{4}$
3	2	3
7	6	5
4	0	0
9	9	$9\frac{1}{2}$

(45)			(46)			(47)			(48)		
£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
3	2	0	9	8	$7\frac{1}{4}$	3	7	$8\frac{3}{4}$	6	1	5
1	8	$9\frac{1}{2}$	9	9	$10\frac{3}{4}$	3	7	$8\frac{3}{4}$	2	3	11
4	1	$9\frac{1}{4}$	9	3	$7\frac{3}{4}$	3	7	$8\frac{3}{4}$	9	7	6
1	4	$0\frac{1}{2}$	5	7	$8\frac{3}{4}$	3	7	$8\frac{3}{4}$	8	7	10
5	2	$9\frac{3}{4}$	6	6	$6\frac{1}{2}$	3	7	$8\frac{3}{4}$	8	9	9
9	8	7	7	5	$2\frac{1}{4}$	3	7	$8\frac{3}{4}$	5	7	3
2	7	$6\frac{1}{2}$	3	0	$4\frac{1}{4}$	3	7	$8\frac{3}{4}$	3	4	6
1	6	3	4	2	$2\frac{1}{4}$	3	7	$8\frac{3}{4}$	8	6	3
4	3	$2\frac{1}{4}$	2	9	$11\frac{1}{2}$	3	7	$8\frac{3}{4}$	9	8	7
			7	6	$3\frac{3}{4}$	3	7	$8\frac{3}{4}$	2	3	2

(49)			(50)			(51)			(52)		
£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
1	6	$11\frac{1}{2}$	1	0	$9\frac{1}{4}$	7	6	$8\frac{1}{2}$	8	5	$3\frac{1}{4}$
2	7	$6\frac{3}{4}$	2	8	$7\frac{1}{2}$	1	5	$11\frac{3}{4}$	9	6	4
3	8	$5\frac{1}{4}$	3	6	$5\frac{3}{4}$	2	7	3	7	3	$11\frac{1}{2}$
4	1	$7\frac{1}{4}$	6	4	$11\frac{1}{4}$	3	8	$5\frac{1}{2}$	7	8	10
5	9	$4\frac{1}{2}$	4	9	$10\frac{3}{4}$	8	9	8	9	5	$6\frac{3}{4}$
6	2	$8\frac{3}{4}$	8	7	$8\frac{1}{2}$	9	1	$7\frac{1}{4}$	8	3	7
7	3	$3\frac{1}{4}$	9	4	$5\frac{1}{2}$	4	4	6	8	7	$7\frac{3}{4}$
8	5	$9\frac{3}{4}$	3	3	$2\frac{3}{4}$	6	2	$2\frac{3}{4}$	9	5	9
9	4	$2\frac{1}{2}$	7	9	$4\frac{1}{4}$	5	6	10	7	6	$4\frac{1}{2}$
9	0	$10\frac{1}{2}$	4	4	$6\frac{1}{2}$	5	3	8	7	8	6
						5	3	$1\frac{1}{4}$	9	3	$3\frac{1}{4}$
									6	2	$5\frac{1}{2}$

EXERCISE II.

(1)			(2)			(3)		
£.	s.	d.	£.	s.	d.	£.	s.	d.
538	13	$10\frac{1}{2}$	7040	19	$1\frac{1}{2}$	42768	7	$8\frac{1}{2}$
8427	15	$8\frac{3}{4}$	86	13	$5\frac{3}{4}$	13590	13	$2\frac{3}{4}$
13	17	11	942	8	$7\frac{1}{4}$	276	12	$1\frac{1}{4}$
642	8	$7\frac{1}{2}$	2568	10	$10\frac{1}{2}$	8402	5	$8\frac{3}{4}$
						35679	16	$3\frac{3}{4}$

(4)			(5)			(6)		
£.	s.	d.	£.	s.	d.	£.	s.	d.
796	15	$8\frac{3}{4}$	7684	7	$8\frac{1}{2}$	786	13	10
1248	19	11		15	$3\frac{1}{4}$	5419	12	8
2125	13	$10\frac{3}{4}$		19	13 10		8	17 6
203	4	$3\frac{1}{4}$	256	15	$11\frac{3}{4}$	427	11	2
8751	0	1	1825	8	$4\frac{1}{4}$	2040	13	3
2125	13	$10\frac{3}{4}$	32769	12	$9\frac{1}{2}$	966	16	6
			82103	1	7	7045	1	11

(7)			(8)		
£.	s.	d.	£.	s.	d.
2197	12	$10\frac{1}{4}$	127556	11	$4\frac{1}{2}$
1208	0	$8\frac{1}{2}$	71042	2	3
319	14	$11\frac{3}{4}$	48931	19	$7\frac{1}{4}$
9420	9	$9\frac{3}{4}$	1632197	3	$6\frac{1}{2}$
8531	16	$7\frac{1}{2}$	49823	18	$9\frac{3}{4}$
7642	1	$2\frac{1}{4}$	3286	5	8
6753	18	$6\frac{3}{4}$	254719	16	$10\frac{1}{2}$
5864	3	$5\frac{1}{2}$	6609	7	$11\frac{1}{2}$

(9)			(10)		
£.	s.	d.	£.	s.	d.
416	13	11	1678	18	$11\frac{1}{2}$
5274	14	6	5246	17	10
3708	5	8	356	13	$5\frac{3}{4}$
2415	9	9	8562	5	9
56780	17	3	3427	6	$0\frac{1}{2}$
26317	6	4		6	$11\frac{1}{4}$
8412	18	10	249	12	$3\frac{1}{2}$
90710	4	1	8542	6	$0\frac{1}{4}$
11768	12	2	67	10	$8\frac{1}{4}$
1259	17	5	243	19	$2\frac{1}{2}$
32708	8	7	14274	8	$4\frac{3}{4}$
673591	19	6	57343	9	$10\frac{3}{4}$

(11) Add five hundred and thirty-nine pounds, fifteen shillings and sevenpence ; eighteen pounds, nine shillings and twopence three farthings.

(12) Add four hundred and sixty-seven pounds, ten shillings and ninepence halfpenny ; eight thousand, four hundred and fourteen pounds, three shillings and sevenpence halfpenny ; six pounds, six shillings and sixpence halfpenny.

(13) Add five hundred and fifty-eight pounds, four shillings and ninepence three farthings ; twenty-five pounds, fifteen shillings and twopence three farthings ; five hundred and thirty-two pounds, nine shillings and sevenpence ; seven thousand and ten pounds, eleven shillings and fourpence halfpenny.

(14) Add four thousand, two hundred and seventy-nine pounds, thirteen shillings and eightpence halfpenny ; one hundred and seventy-six pounds, fifteen shillings and ninepence ; two thousand and forty pounds, eleven shillings and tenpence farthing ; one thousand, eight hundred and fifty-seven pounds, sixteen shillings and ninepence halfpenny ; eight hundred and fifty-five pounds, five shillings and fivepence three farthings.

(15) Add eight hundred and fifty-three pounds, twelve shillings and ninepence ; one thousand, eight hundred and sixty-six pounds, four shillings and tenpence ; eight hundred and fifty-one pounds, two shillings and elevenpence ; two thousand, eight hundred and twenty-five pounds, eight shillings and fourpence ; seventy-six thousand, nine hundred and two pounds, eleven shillings and threepence ; sixteen thousand, seven hundred pounds, nineteen shillings and elevenpence.

(16) Add nine thousand, two hundred and ten pounds, three shillings and sevenpence three farthings ; eight thousand, one hundred and twenty-seven pounds, and one shilling ; eight thousand, eight hundred and eighty-eight pounds and elevenpence halfpenny ; fifty-three pounds, thirteen shillings and eightpence halfpenny ; twelve thousand and seventy-two pounds, three shillings and one penny ; nine hundred and seventy-eight pounds, sixteen shillings and threepence farthing ; four thousand and sixty-three pounds, fifteen shillings and sixpence halfpenny.

(17) Add four thousand, six hundred and five pounds, one shilling and tenpence halfpenny ; two thousand and thirty-one pounds, fifteen shillings and threepence three farthings ; twenty-six thousand, six hundred and sixty-four pounds, twelve shillings and tenpence halfpenny ; one hundred and sixty-one pounds, one shilling and one penny halfpenny ; four thousand and twenty-four pounds, seven shillings and one farthing ; two thousand, nine hundred and fourteen pounds, four shillings and fourpence farthing ; ten thousand, five hundred and seven pounds, seventeen shillings and sevenpence three farthings ; thirty-one thousand, five hundred and twenty-three pounds, twelve shillings and elevenpence farthing.

(18) Add one thousand, five hundred and eighty-three pounds, eleven shillings and threepence ; two hundred and sixty pounds, two shillings and fourpence ; nine hundred and thirty-seven pounds, seventeen shillings and tenpence ; seven thousand and sixty-four pounds, five shillings and eightpence ; five hundred and twenty-five pounds, nineteen shillings and twopence ; three hundred and forty-eight pounds, six shillings and one penny ; sixty-nine pounds, thirteen shillings and ninepence ; eight thousand, seven hundred and eight pounds, four shillings and elevenpence ; nine hundred and twenty-nine pounds, eighteen shillings and sevenpence.

(19) Add ninety-one thousand and twenty-one pounds, ten shillings and eightpence farthing ; twenty-eight thousand, nine hundred and forty-three pounds, seventeen shillings and sixpence three farthings ; three thousand, seven hundred and ninety pounds, two shillings and fourpence ; eight hundred and sixty-eight pounds, fifteen shillings and ninepence halfpenny ; five thousand and seventy-five pounds, nine shillings and tenpence halfpenny ; six thousand, seven hundred and fifty-four pounds, sixteen shillings and fivepence halfpenny ; five hundred and thirty-eight pounds, seven shillings and elevenpence ; four thousand, two hundred and thirteen pounds, twelve shillings and twopence three farthings ; one thousand, nine hundred and sixty-seven pounds, five shillings and threepence ; two thousand and sixty-four pounds, thirteen shillings and sevenpence farthing.

(20) Add sixty-three thousand, one hundred and eighty-five pounds, twelve shillings and elevenpence halfpenny ; fifteen thousand, three hundred and eighty-four pounds, ten shillings and eightpence ; eight shillings and tenpence farthing ; three hundred and ninety-three thousand, seven hundred and eight pounds, six shillings and fivepence ; thirty-two thousand, eight hundred and nine pounds, four shillings and threepence three farthings ; forty-seven pounds, two shillings and fourpence halfpenny ; twenty-seven thousand, five hundred and twelve pounds, nineteen shillings and twopence halfpenny ; one thousand, seven hundred and sixty pounds, thirteen shillings and sixpence ; three thousand, six hundred and ten pounds, seven shillings and sevenpence three farthings ; thirty-nine thousand, three hundred and seventy pounds, eleven shillings and one penny three farthings ; six hundred and twenty-one thousand, three hundred and eighty-two pounds, five shillings and one halfpenny ; three million, five hundred and thirty-one thousand, six hundred and fifty-eight pounds, nine shillings and ninepence three farthings.

EXERCISE III.

(1)	(2)	(3)	(4)
1768	2416	4907	8947
94	80519	356	397
550	9743	4520	8276
		38271	50703
(5)	(6)	(7)	(8)
4210	98376	650234	78903
349	4297	152467	4782
5827	376	24901	194763
631	4788	933378	4936
7856	76847	8426	531
		151	74267

(9)	(10)	(11)	(12)
265168	142857	9	48793561
521797	428571	87	20907528
293622	285714	654	7841
370448	857142	3210	25
452451	571428	98765	3069
538196	714285	432109	97856
554303	142857	8765432	867924
		10987654	1250708
(13)	(14)	(15)	(16)
987654321	9518581	16470431	8463243
987654321	829326	30	773904
987654321	70394	7180359	58654
987654321	6207	21642	327760
987654321	41574	85	9983
987654321	536342	3617	41732044
987654321	6019483	706596	75783
987654321	75620	482575	245477
987654321	8179	8429	3685473
		23869397	266599
(17)	(18)	(19)	(20)
8376214	6142	310531	8476231
5976414	250	973572	763249
635523	2035	861627	35604
46877	367	740537	9094
39256479	47498	810453	47776
99783	5809	168179	392448
246804	597	620438	7553210
8975578	196	975162	14578239
342429	6071	289705	278547
81660	38276	496561	6298
73431	3148	424280	17844
		983276	12345678

EXERCISE IV.

(1) John played at marbles and won on Monday 43 marbles, on Tuesday 101, on Wednesday 8, on Thursday 19, on Friday 119, and on Saturday 50. How many did he win in the week?

(2) In a certain school there are 67 boys, 59 girls, and 111 infants. How many pupils are there?

(3) The Books of Moses consist of 187 chapters, the Histories of 226, the Prophecies of 273, Job of 42, and the writings of David and Solomon of 201. How many chapters are there in the Old Testament?

The New Testament contains 260 chapters. How many chapters are there in the whole Bible?

(4) The battle of Thermopylæ took place 490 B.C., that of Bunker's Hill 1775 A.D. Find the time intervening between the two?

(5) How much money do I require to pay the following bills: butcher, £23. 7s. 6d.; baker, £9. 18s. 10d.; greengrocer, £1. 5s. 9d.; grocer, £7. 13s. 2d.; milkman, £2. 11s. 3d.; tailor, £15. 10s.; shoemaker, £7. 8s. 9d.; stationer, £4. 7s. 11d.; wine merchant, £8. 15s.?

(6) A cashier begins January with £48. 10s. 10d. in his till; there is paid him £75 in January, £120. 16s. 4d. in each of the next three months. How much will he then have to account for?

(7) A person left £3619. 6s. 8d. to each of his six children. Find the amount received by all of them.

(8) A farmer sold 2 oxen for £45. 12s. 6d., a calf for £7. 15s., 2 pigs for £12. 12s., 4 sheep for £10, and 3 lambs at 17s. 9d. each. How many animals did he bring to market, and for how much did he sell them?

(9) A has 43 oxen, 145 sheep, 31 cows, and 19 horses; B has 57 lambs, 215 sheep, 8 horses, 7 pigs, and 10 calves; C has 60 lambs, 22 oxen, 89 sheep, and 12 calves; D has 67 cows, 28 horses, 11 pigs, and 3 lambs; E has 11 horses, 5 calves, 10 oxen, and 25 cows; F has 100 lambs, two herds of 37 oxen each, two flocks of sheep, one of 93 and the other of 39, and 50 pigs. How many animals are there of each kind, and how many altogether?

EXERCISE V.

(1)

£.	s.	d.
134	6	6
232	1	$11\frac{1}{4}$
1067	17	$9\frac{1}{2}$
4032	12	1
9416	9	$8\frac{1}{2}$
1067	13	8
1279	8	$7\frac{3}{4}$
4610	3	$2\frac{1}{4}$
752	15	$3\frac{1}{2}$
7187	10	$3\frac{1}{2}$
9312	8	$5\frac{1}{2}$

(2)

£.	s.	d.
13257	8	$11\frac{1}{2}$
3276	5	$9\frac{1}{4}$
46	3	$6\frac{3}{4}$
1287	14	$7\frac{1}{2}$
4917	10	8
147	0	$6\frac{3}{4}$
360	5	5
1379	17	$2\frac{3}{4}$
9	9	$10\frac{1}{2}$
1340	16	$9\frac{1}{4}$
906	10	$7\frac{1}{2}$
2222	5	1

(3)

73191211
31442376
16310732
6904109
432173041
92761528
13971140
105633198
78042
259766

(4)

5497530
5811756
761110
4028211
77436917
14376215
29351528
15286408
190589374
7319631
6911414
5016436
56616
1189401
7116917

EXERCISE VI.

(1)

£.	s.	d.
778	4	5
536	2	4

(3)

46596	17	10
13282	12	4

(5)

4897	7	7
1624	8	11

(7)

7638	14	$3\frac{1}{2}$
147	17	$4\frac{1}{2}$

(9)

9472	4	$5\frac{1}{2}$
8763	15	$4\frac{1}{2}$

(11)

346004	1	$2\frac{1}{2}$
76802	14	$0\frac{1}{4}$

(13)

130764	11	3
68943	13	$6\frac{1}{2}$

(15)

70	10	$0\frac{1}{2}$
6	16	$8\frac{3}{4}$

(17)

1000	0	0
999	19	$11\frac{1}{2}$

(19)

500	0	0
367	18	$10\frac{1}{4}$

(2)

£.	s.	d.
9999	19	$11\frac{1}{2}$
9876	5	$4\frac{1}{2}$

(4)

8712	15	3
930	8	7

(6)

8713	18	$9\frac{1}{2}$
1784	19	$11\frac{1}{2}$

(8)

72312	5	$9\frac{3}{4}$
16743	8	$10\frac{1}{2}$

(10)

81403	15	$7\frac{1}{2}$
68	0	11

(12)

49060	12	$1\frac{1}{2}$
893	15	$3\frac{1}{2}$

(14)

40076	0	$5\frac{1}{2}$
16307	9	$8\frac{1}{4}$

(16)

382	0	$0\frac{1}{4}$
187	0	$11\frac{1}{2}$

(18)

53761	0	0
7777	7	7

(20)

8000	0	0
796	17	$2\frac{1}{2}$

EXERCISE VII.

(1)	(2)	(3)
734968	625137	435768
123454	214021	123989
(4)	(5)	(6)
243617	310703	57345
76329	25844	16462
(7)	(8)	(9)
3467825	3087902	1000000
178062	396999	999999
(10)	(11)	(12)
376462	857142	401050
84752	428571	123456
(13)	(14)	(15)
876543	543645	283461
777777	137968	99999
(16)	(17)	(18)
194580	422060	1147368
63245	234681	654891
(19)	(20)	
5000807	100100	
283876	11111	

EXERCISE VIII.

(1) Take one hundred and ninety-six thousand, seven hundred and thirty-four, from three hundred and twenty-one thousand, seven hundred and eight; also four thousand, one hundred and five pounds, thirteen shillings and eightpence three farthings, from twelve thousand and nineteen pounds, sixteen shillings and twopence halfpenny.

(2) Find the difference between one million, one hundred and seventy-eight thousand, four hundred and fifty-eight, and one mil-

lion, seven hundred and eighty thousand, four hundred and twelve ; also between fifty thousand, one hundred pounds, two shillings and twopence, and sixteen thousand, eight hundred and seventy-two pounds, thirteen shillings and tenpence halfpenny.

(3) Find the excess of one hundred and five pounds, three shillings and one farthing, over eighty-three pounds, sixteen shillings and ninepence halfpenny ; also of seven thousand and fifteen over two thousand, four hundred and six.

(4) How much must I add to thirteen thousand, five hundred and two pounds, nine shillings and threepence, to get forty thousand pounds ; also to sixty-two thousand, three hundred and eighteen, to get one hundred thousand ?

(5) What must I take away from eleven thousand, one hundred and eleven pounds, eleven shillings and one penny farthing, to leave three thousand, eight hundred and five pounds, sixteen shillings and twopence halfpenny ; also from one million, ten thousand, one hundred and one, to leave nine hundred and nine thousand, nine hundred and nine ?

(6) The latitude of London is $51\frac{1}{2}^{\circ}$ N. ; that of the Tropic of Cancer is $23\frac{1}{2}^{\circ}$ N. How many degrees is London north of this Tropic ?

(7) If I gain thirty-seven thousand, one hundred and five pounds, eight shillings and threepence halfpenny, and lose fifty thousand, six hundred and two pounds, nine shillings and tenpence, how much shall I have gained or lost altogether ?

(8) In a certain school there are 102 pupils, of whom 67 are boys and the remainder girls. How many girls are there ?

(9) A father is 42 years of age, and his eldest son was born when he was 26 years old. How old is the son now ? Also, by how much is the father older than the son, and how much older than the son will the father be 12 years hence ?

(10) It is now eleven o'clock a.m. What o'clock was it 6, 12, 15, and 24 hours ago ?

EXERCISE IX.

(1) To how many persons can I give £19. 16s. 3½d. each, if I have £138. 14s. 2¼d.?

(2) How many shares can I buy for £1120. 10s., if each costs £93. 7s. 6d.?

(3) How many times can I subtract £8. 9s. 4d. from £67. 14s. 8d.?

(4) How many heaps of 56 marbles each can I make out of 500 marbles?

(5) If I travel 144 miles a day, how many days shall I take to travel 1008 miles?

(6) How many strips of carpet, each 17 yards long, can I get out of 160 yards of carpet?

EXERCISE X.

Miscellaneous Examples.

(1) *a.* Read off: LVIII, LXIX, CXLVII, CCXCIV, MXC, MDCCCIV, MDXIX, MC, DCCCCIX, MDCCCLXIX.

b. Write in Roman Notation: Six; four; eleven; twenty-nine; one hundred and forty-four; six hundred and sixty-six; one thousand, two hundred and two; eleven hundred and forty-four; twelve hundred and ninety-nine; one thousand, two hundred and thirty-four.

(2) *a.* Write in words: 1008; 13015; 7012009; 4226843; 60606060; 987654321; 42105; 24150; 116001; 110061.

(*b.*) Write with Arabic Notation in the Decimal Scale: Five thousand and forty; twelve thousand and twelve; twelve hundred and twelve; twelve thousand, twelve hundred and twelve; thirteen millions, fourteen thousand and fifteen; fifty-eight millions; twenty millions, three hundred and sixty-five thousand and nineteen; fifty thousand and fifty; five hundred thousand and fifty; one million, one thousand and ten.

(3) Analyse (aloud or in writing) 3052604.

(4) Alfred the Great died at the age of 52, A.D. 901. In what year was he born?

(5) William the Conqueror began to reign A.D. 1066, and reigned 21 years. In what year did he die?

(6) A travels northwards 203 miles, B travels 167 miles in the same direction. How far will they be apart?

(7) If B had travelled southwards, how far apart would they be?

(8) I am now (A.D. 1869) 37 years old, and the battle of Trafalgar happened 27 years before I was born. In what year was it fought?

(9) Add the sum of 1008 and 639 to their difference.

(10) Take the difference of 1001 and 999 from their sum.

(11) A cashier receives on Monday, £596. 13s. 8d.; on Tuesday, £932. 11s. 4d.; on Wednesday, £403. 6s. 4d.; on Thursday, £67. 8s. 8d.; on Friday, £145. 17s. 6d.; and on Saturday, £854. 2s. 6d. His expenditure is on Monday, £139. 19s. 11d.; on Tuesday, £369. 8s. 10d.; on Wednesday, £860. 0s. 1d.; on Thursday, £630. 11s. 2d.; on Friday, nothing; on Saturday, £319. 9s. 9d. Find the balance in hand at the end of each day of the week.

(12) My income is £500 a-year. I spend £14. 3s. 6d. each quarter for rent; £3. 10s. 10½d. each quarter for taxes; £9. 3s. 4d. each half-year for insurance; £156 per annum for food, &c.; £7. 4s. for coals during the winter, and £1. 16s. during the summer; and £33. 6s. 8d. a-year schooling for *each* of three children. How much a-year is left me for other purposes?

(13) If I spend £2. 17s. 4d. a-week, having £16 on leaving home, how much shall I bring back after 5 weeks' holiday?

(14) If I spend every week 15s. 9d. for lodging; £1. 1s. for board; 4s. 6d. for travelling; 8s. 4d. for sundries; how long will £15 last me, and how much shall I be in debt at the end of 7 weeks?

(15) How many months of 30 days each are there in the 365 days of the year?

(16) An army consisted of 50,000 soldiers before the battle. The list of casualties was as follows: killed, 3768 men and 419 officers; wounded, 9483 men and 2716 officers; missing, 802 men and 1 officer. What was the strength of the army after the battle?

(17) On the 1st of January I bought goods for £50. 18s. 6d., and paid £10. 10s. on account. The balance is to be paid off in monthly instalments of £5. 15s. 6d. each. On what day shall I pay the last instalment?

(18) A clock and a watch are set at noon on Monday; the clock gains 4 minutes in each of its days (of 24 hours), the watch loses 2 minutes in the same time; what time will the watch indicate on Saturday when it is noon by the clock?

(19) If the clock gains 7 minutes and the watch gains 11 minutes each day by the clock, what time will the watch indicate on Saturday when it is noon by the clock?

(20) If I have £80 in the bank, and put by £52. 10s. a-year, how long shall I be in accumulating £500?

(21) How many times must 6798 be added to 9212 to make 50,000?

(22) I have the following bills to pay: butcher, £14. 7s. 11d.; baker, £5. 9s. 8d.; grocer, £9. 10s. 10d.; greengrocer, 17s. 7d.; milkman, £1. 2s. 3d. How much shall I have left out of £35?

(23) A house with fixtures and furniture is bought for £1050; the price of the furniture is £335, that of the fixtures is £27. 10s. What was the sum paid for the house?

(24) John and Tom play at marbles; John begins with 158 marbles, and Tom with 271; Tom loses 56 marbles. Which has more, and by how much?

(25) At an election there were three polling places. At the first, the Whig candidate obtained 766 votes, and the Tory 695; at the second, the Tory had 523 and the Whig 419; at the third, the Whig had 812, and the Tory 811. Which candidate was elected, and what was his majority?

EXERCISE XI. (a).

(1) How much money will there be in 2 bags, if each contains £245. 13s. $7\frac{1}{2}d.$?

(2) If I travel from London to Liverpool and back, the distance between them being 192 miles, how many miles shall I have travelled?

(3) How many soldiers are there in 2 regiments of 876 soldiers each?

(4) Find the cost of a pair of ponies costing £15. 17s. 6d. each?

(5) A travels 487 miles north, and B the same distance south. How far will they be apart?

(6) Find the double of £2493. 15s. $9\frac{3}{4}d.$

- | | |
|---|---|
| (7) 416296×2 | (14) £34088. 13s. $9\frac{1}{2}d. \times 2$ |
| (8) £40529. 6s. $0\frac{1}{2}d. \times 2$ | (15) 639756×2 |
| (9) 278409×2 | (16) £62977. 5s. $3\frac{1}{4}d. \times 2$ |
| (10) £51732. 17s. $2\frac{3}{4}d. \times 2$ | (17) 847538×2 |
| (11) 301620×2 | (18) £79863. 19s. 10d. $\times 2$ |
| (12) £23154. 8s. $8\frac{3}{4}d. \times 2$ | (19) 925317×2 |
| (13) 510847×2 | (20) £18641. 7s. $11\frac{1}{4}d. \times 2$ |

EXERCISE XI. (b).

(1) How much money will there be in 3 bags, if each contains £567. 18s. $11\frac{1}{2}d.$?

(2) Find the length of the 3 sides of a triangle, if each side is 493 feet long.

(3) How much do I require to give £2045. 7s. 6d. to each of 3 persons?

(4) How many soldiers in 3 armies of 389,012 men each?

(5) Find the value of 3 East-Indiamen, if each is worth £645,900.

(6) What was a man's fortune if he left £66,666. 13s. 4d. to each of his 3 children?

- | | |
|---|---|
| (7) 416296×3 | (14) £34088. 13s. $9\frac{1}{2}d. \times 3$ |
| (8) £40529. 6s. $0\frac{1}{2}d. \times 3$ | (15) 639756×3 |
| (9) 278409×3 | (16) £62977. 5s. $3\frac{1}{4}d. \times 3$ |
| (10) £51732. 17s. $2\frac{3}{4}d. \times 3$ | (17) 847538×3 |
| (11) 301620×3 | (18) £79863. 19s. 10d. $\times 3$ |
| (12) £23154. 8s. $8\frac{3}{4}d. \times 3$ | (19) 925317×3 |
| (13) 510847×3 | (20) £18641. 7s. $11\frac{1}{4}d. \times 3$ |

EXERCISE XI. (c).

- (1) How much money in 4 bags, if each contains £765. 0s. 11d.?
- (2) Find the length of the sides of a square, if each is 894 feet long.
- (3) How much do I owe altogether, if to each of 4 men I owe £321 19s. 10d.?
- (4) How many students in 4 colleges, if there are 465 in each?
- (5) 1 lb. Troy has 5760 grains. How many grains in 4 lbs.?
- (6) 1 cwt. (hundredweight) has 4 qrs. (quarters), and each qr. has 28 lbs. How many lbs. in a cwt.?

- | | |
|---|---|
| (7) 416296×4 | (14) £34088. 13s. $9\frac{1}{2}d. \times 4$ |
| (8) £40529. 6s. $0\frac{1}{2}d. \times 4$ | (15) 639756×4 |
| (9) 278409×4 | (16) £62977. 5s. $3\frac{1}{4}d. \times 4$ |
| (10) £51732. 17s. $2\frac{3}{4}d. \times 4$ | (17) 847538×4 |
| (11) 301620×4 | (18) £79863. 19s. $10d. \times 4$ |
| (12) £23154. 8s. $8\frac{3}{4}d. \times 4$ | (19) 925317×4 |
| (13) 510847×4 | (20) £18641. 7s. $11\frac{1}{2}d. \times 4$ |

EXERCISE XI. (d).

- (1) How much money in 5 bags, if each contains £4039. 18s. $7\frac{1}{2}d.$?
- (2) How many petals are there in 376 forget-me-nots?
- (3) What would be my income in 5 years at £2765. 10s. 10d. a-year?
- (4) Find the length of the sides of a pentagon, if each is 137 inches long.
- (5) A spends 5 times as much as B, whose yearly outlay is £941. 7s. 4d. Find A's expenditure.
- (6) How far will a wheel 5 yards in circumference travel in making 3068 turns?

- | | |
|---|---|
| (7) 416296×5 | (14) £34088. 13s. $9\frac{1}{2}d. \times 5$ |
| (8) £40529. 6s. $0\frac{1}{2}d. \times 5$ | (15) 639756×5 |
| (9) 278409×5 | (16) £62977. 5s. $3\frac{1}{4}d. \times 5$ |
| (10) £51732. 17s. $2\frac{3}{4}d. \times 5$ | (17) 847538×5 |
| (11) 301620×5 | (18) £79863. 19s. $10d. \times 5$ |
| (12) £23154. 8s. $8\frac{3}{4}d. \times 5$ | (19) 925317×5 |
| (13) 510847×5 | (20) £18641. 7s. $11\frac{1}{2}d. \times 5$ |

EXERCISE XI. (e).

- (1) How much money in 6 bags of £4807. 6s. $11\frac{1}{4}d.$ each?
- (2) Find the number of pages in 6 volumes, if each volume has 483 pages.
- (3) Find the cost of 6 locomotives, if each costs £2095. 13s. 4d.
- (4) Find the length of the sides of a hexagon, if each is 529 inches in length.
- (5) The daily expenditure of an office in the city is £17. 13s. 10d. How much is this a-week?
- (6) A mile has 880 fathoms. How many feet has it (a fathom being 6 feet)?
- (7) 416296×6
- (8) £40529. 6s. $0\frac{1}{2}d. \times 6$
- (9) 278409×6
- (10) £51732. 17s. $2\frac{3}{4}d. \times 6$
- (11) 301620×6
- (12) £23154. 8s. $8\frac{3}{4}d. \times 6$
- (13) 510847×6
- (14) £34088. 13s. $9\frac{1}{2}d. \times 6$
- (15) 639756×6
- (16) £62977. 5s. $3\frac{1}{4}d. \times 6$
- (17) 847538×6
- (18) £79863. 19s. $10d. \times 6$
- (19) 925317×6
- (20) £18641. 7s. $11\frac{1}{4}d. \times 6$

EXERCISE XI. (f).

- (1) How much money in 7 bags, each containing £6429. 15s. $3\frac{1}{2}d.$?
- (2) How many minutes in a week, a day consisting of 1440 minutes?
- (3) If living costs me 13s. $9\frac{1}{2}d.$ a-day, how much do I require a-week?
- (4) Find the length of the sides of a heptagon, each side being 748 inches long.
- (5) Find the difference between 52 weeks and a year (of 365 days).
- (6) The seventh part of a ton is 320 lbs. How many lbs. are there in a ton?
- (7) 416296×7
- (8) £40529. 6s. $0\frac{1}{2}d. \times 7$
- (9) 278409×7
- (10) £51732. 17s. $2\frac{3}{4}d. \times 7$
- (11) 301620×7
- (12) £23154. 8s. $8\frac{3}{4}d. \times 7$
- (13) 510847×7
- (14) £34088. 13s. $9\frac{1}{2}d. \times 7$
- (15) 639756×7
- (16) £62977. 5s. $3\frac{1}{4}d. \times 7$
- (17) 847538×7
- (18) £79863. 19s. $10d. \times 7$
- (19) 925317×7
- (20) £18641. 7s. $11\frac{1}{4}d. \times 7$

EXERCISE XI. (g).

- (1) How much money in 8 bags, each containing £5786. 13s. 7½d.?
- (2) A mile has 8 furlongs, and a furlong has 660 feet. How many feet in a mile?
- (3) If one man pays 3s. 9¼d. for his dinner, what will a party of 8 pay?
- (4) Find the length of the sides of an octagon, if each side is 237 inches long.
- (5) Find the cost of 8 railway tickets at £1. 15s. 6d. each.
- (6) A certain city has 47,968 houses; if, on an average, each has 8 windows, how many windows are there altogether?
- (7) 416296×8
- (8) £40529. 6s. 0½d. $\times 8$
- (9) 278409×8
- (10) £51732. 17s. 2¾d. $\times 8$
- (11) 301620×8
- (12) £23154. 8s. 8¾d. $\times 8$
- (13) 510847×8
- (14) £34088. 13s. 9½d. $\times 8$
- (15) 639756×8
- (16) £62977. 5s. 3¼d. $\times 8$
- (17) 847538×8
- (18) £79863. 19s. 10d. $\times 8$
- (19) 925317×8
- (20) £18641. 7s. 11¼d. $\times 8$

EXERCISE XI. (h).

- (1) How much money in 9 bags, each containing £5437. 6s. 7¼d.?
- (2) How many ninepins are there in 403 sets?
- (3) What salary shall I draw in 9 months at £13. 2s. 6d. a-month?
- (4) Find the length of the sides of a nonagon, each side being 222 inches long.
- (5) What will be the cost of a terrace of 9 houses at £1166. 13s. 4d. each?
- (6) A sovereign weighs 123 grains; how many grains should 9 sovereigns weigh?
- (7) 416296×9
- (8) £40529. 6s. 0½d. $\times 9$
- (9) 278409×9
- (10) £51732. 17s. 2¾d. $\times 9$
- (11) 301620×9
- (12) £23154. 8s. 8¾d. $\times 9$
- (13) 510847×9
- (14) £34088. 13s. 9½d. $\times 9$
- (15) 639756×9
- (16) £62977. 5s. 3¼d. $\times 9$
- (17) 847538×9
- (18) £79863. 19s. 10d. $\times 9$
- (19) 925317×9
- (20) £18641. 7s. 11¼d. $\times 9$

EXERCISE XI. (i).

- (1) How much money in 10 bags, each containing £5846. 17s. 10½d.?
- (2) How many fingers (and thumbs) will 798 men have?
- (3) Find the value of 10 shares at £93. 17s. 6d. each.
- (4) How many hundreds in 5786 thousands?
- (5) Find the expenditure of 10 years at £1048. 19s. 10d. a-year.
- (6) How many tens in 75964 hundreds?
- (7) 416296×10
- (8) £40529. 6s. 0½d. $\times 10$
- (9) 278409×10
- (10) £51732. 17s. 2¾d. $\times 10$
- (11) 301620×10
- (12) £23154. 8s. 8¾d. $\times 10$
- (13) 501847×10
- (14) £34088. 13s. 9½d. $\times 10$
- (15) 639756×10
- (16) £62977. 5s. 3¼d. $\times 10$
- (17) 847538×10
- (18) £79863. 19s. 10d. $\times 10$
- (19) 925317×10
- (20) £18641. 7s. 11¼d. $\times 10$

EXERCISE XII. (a).

- (1) Find the cost of 7 articles, at £3. 4s. 5d. each.
- (2) Multiply £68419. 11s. 2½d. by 1.
- (3) Multiply £768. 13s. 9d. by 10.
- (4) Multiply 7686875 by 10.
- (5) Repeat £9. 13s. 8¼d. 6 times.
- (6) Simplify $9684375 + 9684375 + 9684375 + 9684375$.
- (7) Take £19. 14s. 2¾d. 7 times.
- (8) Find the amount of 7 collections, each containing 197114583 things.
- (9) What shall I spend in 5 years if I spend £476. 13s. 8d. a-year?
- (10) How many men are there in 6 regiments of 936 men each?
- (11) How many sheep in 8 flocks of 147 sheep each?
- (12) How much must be paid for 6 locomotives at £3126 each?

- (13) How far shall I travel in 9 days, if I travel 672 miles a-day?
- (14) Find the double of £5943. 14s. 6d.
- (15) Find the length of 4 journeys of 1768 miles each.
- (16) The Bank of England sent to the Bank of France 3 chests of money, each containing £147,916. How much money in all?
- (17) How many legs have 683 sheep, 429 oxen, and 715 horses?
- (18) How many legs have 326 men, 519 ostriches, and 478 canaries?
- (19) How many toes have they?
- (20) I bought 9 articles at 13s. 10½d. each; 6 of them I sold at 15s. 4½d. each, and 3 at £1 each. How much did they all cost me, for how much did I sell them all, and what profit did I make?

EXERCISE XII. (b).

- (1) To 7 times 4709, add 7037.
- (2) To 4 times 6835, add 5 times 216.
- (3) Find the difference between 6 times 5987 and 3 times 9412.
- (4) Which is the greater, and by how much, 8×3104 , or 7×4080 ?
- (5) Multiply the sum of £8417. 13s. 11d., £359. 16s. 8d., £1043. 3s. 2½d., £6. 11s. 10¼d., £428. 5s. 9½d., and £7932. 17s. 11d., by 9.
- (6) Multiply the difference between £10,000 and £8342. 17s. 10¼d. by 10.
- (7) Multiply the difference between 6×2304 and 8×1728 by 10.
- (8) Multiply the sum of 18451 and 18444 by their difference.
- (9) Prove that $1 \times £3267. 12s. 10d. + 2 \times £3267. 12s. 10d. + 3 \times £3267. 12s. 10d. + 4 \times £3267. 12s. 10d. + 5 \times £3267. 12s. 10d. + 6 \times £3267. 12s. 10d. + 7 \times £3267. 12s. 10d. + 8 \times £3267. 12s. 10d. + 9 \times £3267. 12s. 10d. = 9 \times £3267. 12s. 10d.$ taken 5 times.
- (10) Prove that the same is true of 105894.

- (11) Also of £1084. 7s. $11\frac{1}{2}d.$
- (12) Also of 67321.
- (13) Also of £4729. 18s. 3d.
- (14) Also of 568139.
- (15) Also of £65,478. 17s. $9\frac{3}{4}d.$

EXERCISE XIII.

- (1) Find all the possible pairs of numbers (none exceeding 10) whose sum is 14.
- (2) Do the same with 15, 16, 17, 18, 19.
- (3) Multiply £4279. 13s. $8\frac{1}{2}d.$ by 14, in four different ways, shewing that the results coincide.
- (4) Multiply 2756983 by 15, in three different ways.
- (5) Multiply £835. 11s. $10\frac{3}{4}d.$ by 16, in three different ways.
- (6) Multiply 4102568 by 17, in two different ways.
- (7) Multiply £6179. 14s. $9\frac{1}{4}d.$ by 18, in two different ways.
- (8) Multiply 3490716 by 19.
- (9) Multiply £674. 15s. 9d. by 11.
- (10) Multiply 6747875 by 11.
- (11) Multiply £18792. 9s. $7\frac{1}{4}d.$ by 12.
- (12) Multiply 1356794 by 12.

EXERCISE XIV. (a).

- | | |
|-------------------------|--------------------------|
| (1) 3469875×20 | (5) 96438125×60 |
| (2) 783125×30 | (6) 27649583×70 |
| (3) 1874167×40 | (7) 78415625×80 |
| (4) 1356875×50 | (8) 753125×90 |

EXERCISE XIV. (b).

- | | |
|--|--|
| (1) £346. 19s. 9d. $\times 20$ | (5) £964. 7s. $7\frac{1}{2}d.$ $\times 60$ |
| (2) £78. 6s. 3d. $\times 30$ | (6) £276. 9s. 11d. $\times 70$ |
| (3) £187. 8s. 4d. $\times 40$ | (7) £78. 8s. $3\frac{3}{4}d.$ $\times 80$ |
| (4) £13. 11s. $4\frac{1}{2}d.$ $\times 50$ | (8) 15s. $0\frac{3}{4}d.$ $\times 90$ |

EXERCISE XIV. (c).

- | | |
|--------------------------|---------------------------|
| (1) £29. 13s. 8½d. × 30 | (21) £7. 18s. 5½d. × 18 |
| (2) £29. 13s. 8½d. × 13 | (22) £7. 18s. 5½d. × 80 |
| (3) 29684375 × 30 | (23) 79239583 × 18 |
| (4) 29684375 × 13 | (24) 79239583 × 80 |
| (5) £645. 15s. 8d. × 14 | (25) £56. 19s. 11½d. × 19 |
| (6) £645. 15s. 8d. × 40 | (26) £56. 19s. 11½d. × 90 |
| (7) 6457833 × 40 | (27) 569989583 × 19 |
| (8) 6457833 × 14 | (28) 569989583 × 90 |
| (9) £10. 16s. 9¾d. × 50 | (29) £58. 17s. 8½d. × 15 |
| (10) £10. 16s. 9¾d. × 15 | (30) £58. 17s. 8½d. × 50 |
| (11) 10840625 × 50 | (31) 58884375 × 15 |
| (12) 10840625 × 15 | (32) 58884375 × 50 |
| (13) 9s. 10½d. × 16 | (33) £194. 17s. 2d. × 17 |
| (14) 9s. 10½d. × 60 | (34) £194. 17s. 2d. × 70 |
| (15) 49375 × 16 | (35) 19485833 × 17 |
| (16) 49375 × 60 | (36) 19485833 × 70 |
| (17) 29364583 × 17 | (37) £962. 7s. 6d. × 19 |
| (18) £29. 7s. 3½d. × 70 | (38) £962. 7s. 6d. × 90 |
| (19) £29. 7s. 3½d. × 17 | (39) 962375 × 19 |
| (20) 29364583 × 70 | (40) 962375 × 90 |

EXERCISE XV.

- | | |
|--------------------------|--------------------------|
| (1) £4. 16s. 7½d. × 23 | (16) 34715625 × 75 |
| (2) £4. 16s. 7½d. × 32 | (17) £5. 7s. 6½d. × 61 |
| (3) 483125 × 23 | (18) £5. 7s. 6½d. × 16 |
| (4) 483125 × 32 | (19) 53760416 × 61 |
| (5) £12. 13s. 5¾d. × 34 | (20) 53760416 × 16 |
| (6) £12. 13s. 5¾d. × 43 | (21) £27. 9s. 8¾d. × 77 |
| (7) 126739583 × 34 | (22) 274864583 × 77 |
| (8) 126739583 × 43 | (23) £6. 19s. 10½d. × 82 |
| (9) £26. 17s. 11d. × 46 | (24) £6. 19s. 10½d. × 28 |
| (10) £26. 17s. 11d. × 64 | (25) 69927083 × 82 |
| (11) 2689583 × 46 | (26) 69927083 × 28 |
| (12) 2689583 × 64 | (27) £39. 5s. 7½d. × 98 |
| (13) £34. 14s. 3¾d. × 57 | (28) £39. 5s. 7½d. × 89 |
| (14) £34. 14s. 3¾d. × 75 | (29) 3928125 × 98 |
| (15) 34715625 × 57 | (30) 3928125 × 89 |

EXERCISE XVI.

- (1) Multiply £16. 15s. $8\frac{1}{4}d.$ by 56 in three different ways, shewing that the results coincide.
- (2) 16784375×56 in three ways.
- (3) £82. 9s. $3\frac{1}{2}d.$ $\times 45$ in three ways.
- (4) 82464583×45 in three ways.
- (5) £143. 6s. $10\frac{3}{4}d.$ $\times 20$ in four ways.
- (6) 15809×20 in three ways.
- (7) State the different ways in which we can multiply by 24, 30, 36, 42, 60, 63.

EXERCISE XVII.

- (1) £529. 17s. $8d.$ $\times 100$.
- (2) £8342. 5s. $9\frac{1}{2}d.$ $\times 1000$.
- (3) £7. 11s. $2\frac{3}{4}d.$ $\times 10000$.
- (4) £845. 4s. $10d.$ $\times 100$.
- (5) £3410 $\times 1000000$.
- (6) 3s. $2\frac{1}{2}d.$ $\times 100000$.
- (7) Find the value of a million penny postage stamps.
- (8) If one rupee is worth 1s. $11\frac{1}{4}d.$, what is the value of a lac of rupees (100,000)?
- (9) 42748×100 .
- (10) 609×1000 .
- (11) 5040×10000 .
- (12) 170000×100000 .
- (13) 19×1000000 .
- (14) 1×1000 .
- (15) 3000×1000 .
- (16) 1000×100 .
- (17) 100×10000 .
- (18) 1000×1000 .
- (19) 10000×10000 .
- (20) A million \times a million.

EXERCISE XVIII.

In two ways.	(1)	£47. 19s. 8½d. × 371	(16)	53244 × 5005
	(2)	£612. 9s. 7¼d. × 802	(17)	178 × 16359
	(3)	£8. 3s. 5½d. × 5049	(18)	50070 × 829
	(4)	£9. 0s. 11d. × 62	(19)	69532 × 10101
	(5)	£50. 17s. 10½d. × 10010	(20)	69532 × 11001
	(6)	£471. 13s. 9¾d. × 7021	(21)	69532 × 1010
	(7)	£25. 7s. 4½d. × 280	(22)	69532 × 11111
	(8)	£83. 15s. 3d. × 6400	(23)	69532 × 100100
	(9)	£90. 11s. 2½d. × 180	(24)	69532 × 11011
	(10)	£308. 19s. 1¼d. × 360	(25)	26418 × 210
	(11)	£621. 14s. 9¾d. × 42	(26)	57390 × 4500
	(12)	£495. 6s. 6d. × 840	(27)	256080 × 120
	(13)	36724 × 37	(28)	7439 × 320
	(14)	5809 × 1209	(29)	6428000 × 7200
	(15)	8067 × 2109	(30)	4286 × 5500

(31) Find the daily wages of 367 men at 3s. 4½d. per day each.

(32) How much would this amount to in a year, leaving out 52 Sundays?

(33) Find the cost of 815 articles at 7s. 10¾d. each.

(34) Find the value of 3000 Venetian ducats at 9s. 5d. each.

(35) Find the value of 94375 Prussian thalers at 2s. 10¾d. each.

(36) Find the value of 1722 railway tickets at 1s. 7d. each.

(37) Find the value of a cwt. (112 lbs.) of sugar at 4¾d. per lb.

(38) Find the cost of a ton (20 cwt.) of iron nails at ¾d. per lb.

(39) What is the charge for translating 74 folios at 2s. 4½d. each?

(40) Find the cost of a lb. Troy (5760 grains) at 1¾d. per grain.

(41) What is the yearly rent of a cottage at 3s. 3d. a-week?

(42) Find the yearly rent of a terrace of 165 houses, of which each pays £136. 10s.

(43) Find the strength of an army consisting of 113 regiments of 947 men each.

(44) How many words are there on a page of 29 lines, each line containing 14 words?

(45) How many bricks are there in 306 yards of wall, each requiring 288 bricks?

(46) At the latitude of London, 1 degree (1°) of longitude is very nearly 37 geographical miles. Find the length of the whole parallel (360°).

(47) How many eggs are there in 3080 boxes, each containing 4769 eggs?

(48) How many grains in 68340 lbs. Avoirdupois (7000 grains each)?

(49) How many hours in a year of 365 days?

(50) How many inches will a wheel have travelled over in making 5317 turns, if the circumference of the wheel is 127 inches?

(51) How many yards in the equator, which is 24899 miles in length (1 mile = 1760 yards)?

(52) How many feet in the same (1 yard = 3 feet)?

(53) How many inches in the same (1 foot = 12 inches)?

(54) What is the issue of a newspaper in 13 weeks, the daily issue of which is 97428 copies.

(55) The Penny Cyclopædia consists of 27 vols., each vol. has, on an average, 512 pages, each page has two columns, and each column has 81 lines of about 8 words each. How many words are there in all?

(56) How many ounces in 1 ton Avoirdupois? (see Table.)

(57) How many inches in a mile?

(58) How many farthings in £1?

(59) How many pounds in 143 iron plates, each weighing 5 tons?

(60) Sound travels through air at the rate of 1130 feet per second. How many feet distant is a thunder-cloud if the report is heard 17 seconds after the flash is seen?

(61) Shew that $27043 \times 233 + 27043 \times 419 + 27043 \times 326 = 27043 \times 326 \times 3$.

(62) Shew that $\text{£}7. 11s. 10d. \times 233 + \text{£}7. 11s. 10d. \times 419 + \text{£}7. 11s. 10d. \times 326 = \text{£}7. 11s. 10d. \times 326 \times 3$.

(63) Find the total cost of 43 articles at $5s. 11\frac{1}{4}d.$ each, 107 articles at $13s. 8\frac{1}{2}d.$ each, 2160 articles at $3s. 9\frac{3}{4}d.$ each, and 11 articles at $\text{£}2. 4s. 7d.$ each.

(64) Find the total cost of 243 pieces of T cloths of 30 yards each, at $3\frac{3}{4}d.$ per yard; 67 pieces of sheeting of 38 yards each, at $1s. 10\frac{1}{4}d.$ per yard, 375 pieces of shirtings, at $6s. 2d.$ per piece, and 18750 yards of fents at $1\frac{1}{4}d.$ per yard.

(65) How much change shall I receive out of £100 after paying the following bill: 5 cwt. of sugar at $3\frac{1}{2}d.$ per lb., a chest of tea containing 53 lbs. at $2s. 10\frac{1}{2}d.$ per lb., half a ton of Carolina rice at $3\frac{1}{4}d.$ per lb., 2086 lbs. of raw Ceylon coffee at $5\frac{1}{2}d.$ per lb.?

(66) A farmer sold 437 sheep at £1. 17s. 9d. each, and bought 23 bullocks at £12. 12s. each, and 19 calves at £7. 17s. 6d. each. How much has he left?

(67) If I spend $1s. 9d.$ a-day for a return ticket, travelling six days in the week, how much shall I save in a year (52 weeks) by taking an annual ticket for £25?

(68) I bought 843 articles at £1. 3s. $4\frac{1}{2}d.$ each, and sold them for £1000. What was my profit?

(69) I bought 756 articles for £195, and sold them at $5s. 7\frac{1}{2}d.$ each. What was my gain?

(70) I bought 400 dozen of wine at £1. 15s. 6d. per dozen, and retailed them at $3s. 6d.$ per bottle. Find my profit per dozen; also, in two ways, the profit on the whole.

(71) I bought 325 dozen of wine at $3s. 2d.$ per bottle. For how much must the whole be sold to gain £22. 10s.?

(72) A trader took out to China 24,178 pieces of grey shirting, of 29 yards each, at $2\frac{1}{4}d.$ per yard; 12,089 pieces of print, of 58 yards each, at $4\frac{1}{2}d.$ per yard; 100,000 yards of flannel at $11\frac{1}{2}d.$ per yard, and 2400 dozen handkerchiefs at $1s. 7\frac{1}{2}d.$ per dozen. He brought back 3000 chests of tea, of 35 lbs. each, at $10d.$ per lb.; 16,498 lbs. of raw silk at £1. 3s. $10\frac{1}{2}d.$ per lb., and the remainder in cash. How much money did he bring back?

(73) If I pay £13. 13s. per quarter for rent, £2. 8s. 6d. per quarter for rates, £2. 18s. 9d. a-week for food, $11s. 3d.$ a-week for washing, £42 every half-year for school bills, £15. 12s. 6d. every half-year for life insurance, £35 a-year for clothes, £3. 10s. for coals for the summer half and £7. 7s. for the winter half year, and wish to lay by £120 out of an income of £600 a-year, how much shall I have for other expenses?

(74) A publisher sells a certain book at 3s. 2d. per copy nett ; of this, he pays to the printer, 9½d. per copy ; to the binder, 6¾d. per copy ; to the author, a royalty of 9d. for every copy he sells. Of an edition of 1000 copies, he sells 853 ; the remainder are left on hand. Will he have lost or gained, and how much ?

(75) I bought 2 tons of sugar at 3¼d. per lb. ; 7 cwt. 21 lbs. got damaged. I sold the good sugar at 4d. a pound, and the damaged sugar at 2½d. per pound. What was my gain or loss ?

(76) A person mixed 23 gallons of Jamaica rum at 9s. 7d. per gallon, with 18 gallons of British rum at 7s. 5d. per gallon, and 30 gallons of water ; he sold the mixture at 11s. 6d. per gallon. What was his total gain ?

(77) A person bought 427 yards of cloth at 3s. 8d. per yard ; for how much must he sell the whole so as to gain 7½d. per yard ?

(78) If 8 articles cost £4. 7s. 10½d., what will 56 articles cost ?

(79) If 9 men can dig 43 yards of trench in a given time, how much will 45 men dig in the same time ?

(80) How much in double the time ?

(81) If 3 men build a given wall in 14 days, how long would 1 man take to build it ?

(82) If 20 men build a given wall in 8 days, how long will 10 men take to do it ?

(83) And how long would 4 men take ?

(84) If 3 articles cost 11s. 8½d., what will 27 articles cost ?

(85) If 8 chairs cost £2. 2s. 6d., what will 64 chairs cost ?

(86) If one dozen pens cost 3¼d., what will the gross cost ?

(87) A man bought 28 Bandana handkerchiefs at 7 for £1. 12s. 7½d. ; he sold them at 5s. 9d. each. Find his total profit.

(88) By mistake he entered this profit in his books among the losses ; at the end of the month his books shewed a profit of only £83. 10s. What ought they to have shewn ?

(89) In a given time 9 men can put up 67 yards of fence. How many yards can 63 men put up in treble the time ?

(90) If 17 men can dig a given quantity of trench in a given time, how many men will be wanted to dig 4 times the quantity in a quarter of the time ?

(91) If out of a sack of flour we make 43 shilling loaves, how many threepenny loaves could we have made of it?

(92) Simplify $17 \times (184 - 47 + 62)$.

(93) Simplify $302 \times (5 \times 17 - 3 \times 11)$; $597 \times (5 \times 17 - 9 \times 9)$.

(94) Simplify $6 \times 7 \times (11 \times 156 + 13 \times 84)$.

(95) Simplify $(81 + 317 \times (24 + 11))$.

(96) Simplify $6 \times 8 \times 9 \times 5 \times 4 \times 317$.

(97) Find the continued product of the first 9 numbers.

(98) Shew that $740625 \times 386 + 740625 \times 234 + 740625 \times 1671 + 740625 \times 176 + 740625 \times 809 + 740625 \times 546 = 740625 \times 546 \times 7$.

(99) Shew that $\text{£}7. 8s. 1\frac{1}{2}d. \times 386 + \text{£}7. 8s. 1\frac{1}{2}d. \times 234 + \text{£}7. 8s. 1\frac{1}{2}d. \times 1671 + \text{£}7. 8s. 1\frac{1}{2}d. \times 176 + \text{£}7. 8s. 1\frac{1}{2}d. \times 809 + \text{£}7. 8s. 1\frac{1}{2}d. \times 546 = \text{£}7. 8s. 1\frac{1}{2}d. \times 546 \times 7$.

(100) A bankrupt owes $\text{£}8745$, and can pay $9s. 5\frac{1}{2}d.$ in the $\text{£}1$. What are his assets?

(101) A railway company has 16,200 shares. The expenditure is $\text{£}14,175$. What must be the company's gross income to yield a dividend of $17s. 6d.$ per share?

(102) Multiply the sum of 438619 and 30405 by 198.

(103) Multiply the difference between 438619 and 30405 by 1098.

(104) Multiply the sum of 2815 and 365 by the difference between these two numbers.

(105) From 18 times the product of 519 and 98 take 7 times this product.

EXERCISE XIX.

(1) How many times are $\text{£}5. 7s. 11d.$ contained in $\text{£}16. 3s. 9d.$?

(2) $\text{£}13. 13s. 10d. \div \text{£}3. 8s. 5\frac{1}{2}d.$

(3) If 1 article costs $12s. 7\frac{1}{2}d.$, how many can I buy for $\text{£}4. 8s. 4\frac{1}{2}d.$?

(4) If I save $\text{£}1. 4s. 10\frac{1}{2}d.$ a-week, how long shall I be in accumulating $\text{£}9. 19s.$?

(5) By what number must I multiply $\text{£}8. 4s. 6d.$ to make $\text{£}41. 2s. 6d.$?

(6) To how many persons can I give £3. 15s. each out of £37. 10s.?

(7) If I can travel 65 miles a-day, how long will it take me to get over 520 miles?

(8) If one strip of carpet is 115 inches in length, how many strips can I cut from 1035 inches of carpet?

(9) How many regiments of 875 men each are there in 9625 men?

(10) How many yards of wall can I build with 448 bricks if each yard requires 64 bricks?

(11) How many times are £3. 8s. 10d. contained in £15?

(12) £37. 9s. 4d. ÷ £4. 13s. 7d.

(13) If 1 article costs £1. 5s. 9d., how many can I buy for £8. 1s. 1d.?

(14) If I save £2. 12s. 6d. a month, how long will it take me to accumulate £25?

(15) Out of £18. 4s. 9d. I bought as many sheep as I could at £1. 15s. 6d. each, and with the remainder I bought a lamb. Find the cost of the lamb.

(16) Out of £13. 13s. I bought as many articles as I could at £1. 10s. each. How much more money shall I want to buy one more article?

(17) How many months of 28 days each are there in a year?

(18) If I start Oct. 4th and travel 85 miles a-day, on what day shall I reach a place 450 miles off?

(19) How many periods of 12 minutes are there in 1 hour?

(20) To how many persons can I give £68. 14s. 10d. if I have £600?

EXERCISE XX. (a).

(1) How many articles at £3. 7s. 10½d. each can be bought for £16. 19s. 4½d.?

(2) How many shares at £92. 12s. 6d. can be bought for £926. 5s.?

(3) The passengers in a railway carriage from London to Manchester paid together £6. 3s. 8d.; each ticket cost 15s. 5½d. How many passengers were in the carriage?

- (4) $\pounds 1103 \div \pounds 137$. 17s. 6d.
- (5) A man's weekly expenses were: lodgings, 16s.; food, $\pounds 1$. 1s. 9d.; railway travelling, 5s.; washing, 2s.; sundries, 5s. 3d. How many weeks will $\pounds 30$ last him?
- (6) One hundred and forty children are to be arranged in rows of 14 each. How many rows will there be?
- (7) One hundred and forty-four children are to be seated in rows of 16 children each. How many rows will there be?
- (8) A certain corps d'armée consisted of 10,835 men; each regiment had 859 private soldiers and 126 officers. How many regiments were there?
- (9) How many such corps d'armée in an army of 184,195 men?
- (10) A printer's office employs 9 compositors at $\pounds 1$. 16s. each, 3 pressmen at $\pounds 1$. 16s. each, 2 readers at $\pounds 2$. 10s. each, 1 overseer at $\pounds 3$, 2 boys at 11s. each a-week. How many weeks' wages can be paid with $\pounds 276$. 6s.?
- (11) A sack of potatoes weighs 168 lbs. How many sacks in 1200 lbs.?
- (12) A certain railway had to carry 9000 excursionists; each train could convey 456 passengers. How many trains must have been sent?
- (13) A person earns $\pounds 2$. 7s. a-week, and spends $\pounds 1$. 12s. 6d. a-week. In how many weeks will he save $\pounds 13$. 1s.?
- (14) How many years (of 365 days each) are there in 1000 days?
- (15) $\pounds 427$. 19s. 5d. \div $\pounds 63$. 14s. $2\frac{1}{2}$ d.
- (16) $\pounds 4000 \div \pounds 234$. 5s. 6d.
- (17) $\pounds 876$. 10s. \div $\pounds 43$. 16s. 6d.
- (18) $\pounds 1234$. 5s. 6d. \div $\pounds 89$. 10s. 11d.
- (19) $\pounds 1000 \div \pounds 33$. 6s. 8d.
- (20) $\pounds 500 \div \pounds 16$. 13s. 4d.

EXERCISE XX. (b).

- (1) How many times are $\pounds 5$. 18s. 7d. contained in $\pounds 800$. 8s. 9d.?
- (2) How many articles can I buy for $\pounds 2118$. 18s. $3\frac{1}{2}$ d. if each costs $\pounds 9$. 15s. $3\frac{1}{2}$ d.?

(3) By what number must I multiply £15. 13s. 7d. to obtain £4280. 8s. 3d. for product?

(4) £4973. 11s. 2d. \div £30. 17s. 10d.

(5) If I put by £91. 7s. a-year, how long shall I take to accumulate £1370. 5s.?

(6) I invest £9287. 10s. in railway shares, each costing £92. 17s. 6d. and yielding a yearly income of £3. 10s. each. Find my total yearly revenue.

(7) How many Napoleons at 15s. 9d. each can I get for 189 Prussian thalers at 2s. 10d. each?

(8) $(227 \times £16. 11s. 4d.) \div (28 \times 18s. 11d.)$.

(9) How many guineas are there in £510. 6s.?

(10) A earns £9. 2s. 6d. a-week, and spends £7. 5s. a-week. How long will he be in saving £150?

(11) A man's wages are £1. 17s. 6d. a-week; his wife earns 18s. a-week; his two sons earn 6s. 9d. a-week each. How long must the wages of the family remain unpaid to amount to £79. 7s.?

(12) How many sovereigns, half-sovereigns, crowns, half-crowns, florins, shillings, sixpences, fourpenny-pieces, threepenny-pieces, pennies, halfpennies, and farthings, an equal number of each, can be got from £358. 17s. 5d.?

(13) How manytimes are £3. 18s. 10d. contained in £429. 11s. 3d.?

(14) £5327. 3s. 5d. \div £6. 13s. 2d.

(15) A man's income is £2. 7s. 6d. a-week, and his expenditure, on an average, £3. 1s. 10d., but he has £50 to begin with. How much a-week does he spend more than he gets? How many weeks will the £50 keep him out of debt? And how much will he be in debt after 100 weeks from the commencement?

(16) A certain book cost $7\frac{3}{4}d.$ per copy for the paper, $4\frac{1}{2}d.$ for the printing, $5\frac{1}{2}d.$ for the binding. The total issue cost £110. 18s. 9d. Of how many copies did it consist? And what was the profit on the whole issue if each copy was sold for 2s.?

(17) An omnibus costs to work, 5s. 6d. a-day for the driver, 5s. a-day for the conductor, 8s. 6d. a-week for the keep of each of 8

horses, 6s. 9d. a-week for sundries. These omnibuses run on Sundays. If the weekly expenses amount to £333. 11s. 3d., how many omnibuses are there at work?

(18) How many times can we subtract £1. 3s. $7\frac{1}{2}$ d. from £78,492, and what will be over?

(19) If I have £18. 11s. 9d., and buy as many books as I can at 5s. 3d. each, and with the remainder buy a slate, what did it cost?

(20) With an inheritance of £12,700, I bought as many shares at £92. 7s. 6d. as I could get. How many shares at £1. 9s. 9d. can I buy with the remainder?

(21) How many times must £3. 5s. $8\frac{1}{2}$ d. be added to £562. 12s. 11d. to make £14,000?

(22) Find my income if my income-tax at 7d. in £1 amounts to £14. 2s. 11d.?

(23) How many Napoleons at 14s. $11\frac{1}{2}$ d. each are equal to 718 Prussian thalers at 2s. $10\frac{3}{4}$ d. each?

(24) How many pounds of tea at 2s. 8d. per lb. must be given in exchange for 112 lbs. of coffee at 1s. 2d. per lb., and 88 lbs. of raw sugar at 4d. per lb.?

$$(25) \text{ £1728. } 18s. \div \text{ £4. } 4s. \text{ 9d.}$$

$$(26) \text{ £588. } 7s. \div \text{ £4. } 15s. \text{ 8d.}$$

$$(27) \text{ £181. } 8s. \text{ } 7\frac{1}{2}d. \div 3s. \text{ } 7\frac{1}{2}d.$$

$$(28) \text{ £330} \div 7s. \text{ 4d.}$$

$$(29) \text{ £4559. } 19s. \text{ 6d.} \div \text{ £6. } 4s. \text{ 3d.}$$

$$(30) \text{ £4080} \div \text{ £5. } 13s. \text{ 4d.}$$

$$(31) \text{ £93. } 15s. \div 2\frac{1}{4}d.$$

$$(32) \text{ £16. } 10s. \text{ 9d.} \div 2s. \text{ } 7\frac{1}{2}d.$$

$$(33) \text{ £5611. } 1s. \div \text{ £5. } 12s. \text{ 4d.}$$

$$(34) \text{ £17914. } 11s. \text{ } 11\frac{3}{4}d. \div \text{ £7. } 8s. \text{ } 10\frac{1}{4}d.$$

$$(35) \text{ £734. } 8s. \text{ 2d.} \div \text{ £7. } 1s. \text{ } 1\frac{1}{4}d.$$

$$(36) \text{ £1680} \div \text{ £5. } 7s. \text{ 8d.}$$

$$(37) \text{ £154. } 10s. \div 4s. \text{ } 3\frac{3}{4}d.$$

$$(38) \text{ £3157. } 15s. \text{ 1d.} \div \text{ £7. } 17s. \text{ } 7\frac{1}{4}d.$$

$$(39) \text{ £601000} \div \text{ £823. } 1s. \text{ 4d.}$$

$$(40) \text{ £237. } 15s. \text{ 6d.} \div 2\frac{3}{4}d.$$

$$(41) \text{ £7425. } 18s. \text{ } 10\frac{1}{2}d. \div \text{ £24. } 3s. \text{ } 8\frac{1}{2}d.$$

$$(42) \text{ £90197. } 14s. \text{ } 10\frac{1}{2}d. \div \text{ £81. } 3s. \text{ } 7\frac{3}{4}d.$$

$$(43) \text{ £8378. } 3s. \text{ } 9\frac{1}{2}d. \div \text{ £16. } 3s. \text{ } 5\frac{3}{4}d.$$

$$(44) \text{ £999900} \div \text{ £99. } 19s. \text{ } 11\frac{3}{4}d.$$

EXERCISE XXI.

- (1) Distribute £17,419. 8s. 9d. between 2 persons.
- (2) What is the half of £73. 13s. 9d.?
- (3) Divide £68,422. 5s. 9½d. into 3 equal parts.
- (4) What is the third part of £11,019. 5s. 6d.?
- (5) What sum of money can be subtracted 4 times exactly from £3509. 7s. 6d.?
- (6) What is the quarter of £1007. 1s. 2d.?
- (7) If 5 shares cost £7804. 6s. 8d., what is the cost of each?
- (8) What is the fifth part of £19,001. 2s. 7½d.?
- (9) If I spend £1111 in six years, how much is that for 1 year?
- (10) What is the sixth part of £14. 9s. 3d.?
- (11) What do I spend each day if I spend £19. 3s. 3d. in a week of 7 days?
- (12) What is the seventh part of £85. 14s. 8½d.?
- (13) If the wages of 8 men amount to £5. 9s. 8d., what will each receive?
- (14) What is the eighth part of £19. 7s. 6d.?
- (15) If 9 articles cost £8. 7s. 5½d., what does each cost?
- (16) What is the ninth part of £318. 14s. 0½d.?
- (17) Distribute £519. 6s. 7d. equally among 3 persons.
- (18) Divide £22,865. 9s. 11d. among 7 persons.
- (19) What is the largest sum of money that can be subtracted 9 times from £1000?
- (20) What sum of money subtracted 8 times from £417. 6s. 5½d. will leave a remainder of £19. 11s. 7½d.?
- (21) £43750. 8s. 4d. ÷ 2
- (22) £1316. 9s. 7d. ÷ 3
- (23) £5000 ÷ 4
- (24) £1706. 8s. 6d. ÷ 5
- (25) £1050. 10s. 6d. ÷ 6
- (26) £1050. 10s. 6d. ÷ 7
- (27) £1050. 10s. 6d. ÷ 8
- (28) £1050. 10s. 6d. ÷ 9
- (29) £473. 7s. 5d. ÷ 7
- (30) £751. 1s. 1d. ÷ 8

EXERCISE XXII.

- (1) Divide 17412 things into 2 equal parts.
- (2) What is the half of 358 things?
- (3) Divide 71235 things into 3 equal parts.

- (4) What is the third part of 72861 ?
- (5) What number of things can be subtracted four times exactly from 711136 things ?
- (6) What is the quarter of 1097324 ?
- (7) If 5 equal baskets contain together 3125 apples, what will one basket contain ?
- (8) What is the fifth part of 3116845 ?
- (9) Divide a journey of 528 miles into 6 equal stages.
- (10) What is the sixth part of 2034 ?
- (11) A certain railway guard travels 2303 miles a-week. How much is that a-day ?
- (12) What is the seventh part of 5565 ?
- (13) If 8 horses can draw a load of 3416 lbs., what can 1 horse draw ?
- (14) What is the eighth part of 137904 ?
- (15) If 9 regiments contain 8433 men, how many are there in each ?
- (16) What is the ninth part of 1000008 ?
- (17) Distribute 92763 cartridges among 11 regiments.
- (18) What is the eleventh part of 135795 ?
- (19) If 12 volumes have 6084 pages, how many are there in each ?
- (20) Find the twelfth part of 122436.
- (21) Divide 7034519 separately by 2, 3, 4, 5, 6, 7, 8, 9, 11, 12.
- (22) Divide each of the following numbers by 12 :
- | | | |
|-------------|------------|-------------|
| a. 1000000 | d. 1111111 | g. 106000 |
| b. 4197641 | e. 167625 | h. 17000000 |
| c. 42050000 | f. 4065000 | k. 9052500 |
- (23) What sum of money must be multiplied by 2 to yield £317. 19s. 6d. ?
- (24) What number must be multiplied by 2 to give 173598 ?
- (25) What sum of money must be taken 3 times to yield £1000 ?
- (26) What number must be repeated 3 times to give 14367 ?
- (27) What sum of money multiplied by 4 will amount to £1719. 3s. 6d. ?
- (28) What number multiplied by 4 will give 17003068 ?
- (29) What was the value of each collection, if 5 collections yielded £317. 16s. 10½d. ?

(30) How long is each side of a regular pentagon, if the whole perimeter is 935 inches?

(31) What sum of money must be multiplied by 6 to yield £4379?

(32) What number must be taken 6 times to give 14382?

(33) What is that sum of money which multiplied by 7 gives £962. 5s. $0\frac{1}{2}d.$?

(34) Find the number which multiplied by 7 yields 100569.

(35) What sum of money repeated 8 times will yield £19,000?

(36) What number multiplied by 8 will give 5371016?

(37) What sum of money multiplied by 9 will amount to £384. 15s. $11\frac{1}{2}d.$?

(38) What number multiplied by 9 will give 123456789?

(39) What sum of money multiplied by 11 will give £38,020. 4s. $9\frac{1}{2}d.$?

(40) What number taken 12 times will give 207000?

(41) If 56 articles cost £30. 14s. $11\frac{3}{4}d.$, what will 8 articles cost?

(42) If 45 men dig 430 yards in a given time, how much will 9 men dig in the same time?

(43) If a gross cost 6s. 9d., what will a dozen cost?

(44) If 10 men take 16 days to build a wall, how long will 40 men take?

(45) A man sold 42 Bandana handkerchiefs for £8. 2s. 9d., making a profit of £1. 1s. What did each piece of 7 handkerchiefs cost him?

EXERCISE XXIII.

(1) Distribute £17,802. 19s. $6\frac{1}{4}d.$ among 371 persons.

(2) What sum of money must be multiplied by 135 to yield £2801. 10s. $7\frac{1}{2}d.$?

(3) Distribute £643. 10s. $2\frac{1}{2}d.$ among 815 persons.

(4) What sum of money can be subtracted 750 times exactly from £706. 5s.?

(5) £6043. 11s. 7d. \div 892.

(6) If I spend £507. 19s. 2d. a-year, how much is that a-day?

(7) If I spend £1068. 5s. 6d. a-year, how much is that a-week?

(8) Divide £7003. 3s. $10\frac{3}{4}d.$ into 1867 equal parts.

- (9) If I invest £53,833. 5s. in 1234 shares, what is that per share?
- (10) If I pay £323. 18s. 1d. for 764 pieces of calico of 37 yards per piece, how much does each piece cost, and how much a yard?
- (11) $83094027 \div 9784$. (12) $140940000 \div 13417$.
- (13) $140940000 \div 130417$. (14) $8375808125 \div 18368$.
- (15) $22505600 \div 17312$. (16) $3491938567017 \div 857928$.
- (17) How many bags of 819 marbles can I fill out of 20000 marbles?
- (18) Divide the sum of 71×2117 and 17×1711 by 29.
- (19) Divide the difference between the same quantities by 58.
- (20) What sum of money subtracted 94 times from £848. 6s. 5d. will leave £62. 4s. 11d.?
- (21) How much a-week may I spend out of an income of £374. 12s. 2d. a-year, to save 75 guineas a-year.
- (22) $£118043. 19s. 7\frac{1}{4}d. \div 269$.
- (23) $£1000000 \div 89$. (24) $£1000000 \div 267$.
- (25) $£1000000 \div 1869$. (26) $£1000000 \div 9345$.
- (27) $£1000000 \div 84105$. (28) $£1000000 \div 925155$.
- (29) If 4204800 ounces of provisions are supplied to a regiment of 960 men, giving 12 ounces a-day to each man, how long will the supply last?
- (30) How long would it last if each man had 60 ounces a-day?
- (31) If the regiment were reduced to 800 men, each man having 24 ounces a-day, how long would it last?
- (32) If at the age of 29 I begin business with a capital of £4500, and wish to retire at the age of 60 with a capital of £20,000, what yearly addition must I make to my capital?
- (33) If a million bricks be required, and we have 77331 already, how many loads of 407 bricks each are wanted to complete the number?
- (34) What will be the charge for translating 25344 words, at the rate of 1s. $7\frac{1}{2}d.$ per folio of 72 words?
- (35) $248073019 \div 43017$. (36) $943867315 \div 12604$.
- (37) I sold 1512 articles for £690. 7s. 6d., making a total profit of £123. 7s. 6d. Find the cost of each.

(38)* What sum of money must be multiplied by 623 to yield £733. 6s. $5\frac{1}{2}d.$

(39)* What sum of money must be multiplied by 1246 to yield £733. 6s. $5\frac{1}{2}d.$?

(40)* What sum of money must be multiplied by 623 to yield £366. 13s. $2\frac{3}{4}d.$?

$$(41) \ 12357096 \div 419$$

$$(47) \ 20969 \div 13$$

$$(42) \ 214583206 \div 42576$$

$$(48) \ 100004 \div 17$$

$$(43) \ 366413796 \div 45796$$

$$(49) \ 1010100 \div 19$$

$$(44) \ 166944509 \div 23509$$

$$(50) \ 1000000 \div 37$$

$$(45) \ 19639 \div 23$$

$$(51) \ 3000000 \div 111$$

$$(46) \ 39278 \div 46$$

$$(52) \ 458629725 \div 9625$$

EXERCISE XXIV.

(1) Find the sum of 578, 364, 927, 9768.

(2) What number exceeds 578 by 344 ?

(3) From what sum of money must £42. 11s. 8d. be deducted to leave £57. 8s. 4d. ?

(4) There are two numbers ; the less is 7109, and their difference is 591. Find the greater.

(5) From what number must 316 be taken away to leave 518 ?

(6) If from a certain number 75 is taken, 89 is left. Find the number.

(7) Of two partners A and B, A contributes £520 less than B, whose share is £965. Find the total capital.

(8) 493 exceeds a certain number by 121. Find the number.

(9) What number falls short of 1096 by 421 ?

(10) What number is that to which 2768 must be added to give 10000.

(11) There are two numbers ; the greater is 16520, and their difference is 3736. Find the less.

(12) What number increased by 2743 becomes 12000 ?

(13) Find the product of 69 and 237.

* Examine and compare the quotients in these three.

- (14) What number contains 328 exactly 328 times?
(15) From what number can 5704 be taken exactly 104 times?
(16) From what number can 847 be taken 307 times, leaving a remainder of 49?

- (17) Of what number is 53 the 7th part?
(18) What number divided by 97 gives 204?
(19) What is the 235th part of 141235?
(20) By what number must 397 be multiplied to give 170710?
(21) The product of two numbers is 4539, one factor is 51.
Find the other.

- (22) Given divisor 9373, quotient 103. Find the dividend.
(23) Given dividend 9373, quotient 103. Find divisor.
(24) Given dividend 9373, divisor 103. Find quotient.
(25) What number taken 103 times gives 965419?
(26) Given dividend 99201815, quotient 208, remainder 1207.
Find divisor.

EXERCISE XXV.

- | | |
|----------------------------|--|
| (1) 8417×394 | (12) 73050×9010 |
| (2) 27349×5618 | (13) 20014×1050 |
| (3) 108912×4798 | (14) 68000000×45000 |
| (4) 247863×365 | (15) 2076980×30840 |
| (5) 68354×842 | (16) 385604000×10500 |
| (6) 92731×516 | (17) 30420×103684700 |
| (7) 430597×118 | (18) 437598000×4601700 |
| (8) 2413058×4237 | (19) 2804×43090 |
| (9) 48596×3420 | (20) 5498600×6420 |
| (10) 68043×5070 | (21) $6200 \times 70800 \times 9500$ |
| (11) 4235700×8005 | (22) $5860 \times 2045 \times 902 \times 1000$ |

EXERCISE XXVI.

- | | |
|---------------------------|----------------------------|
| (1) 68497×5268 | (6) 5980000×62490 |
| (2) 427906×6804 | (7) 287963×57846 |
| (3) 72840×5093 | (8) 6248×6248 |
| (4) 476927×20060 | (9) 5743×666 |
| (5) 2748×16900 | (10) 58743×871 |
- (11) Find the continued product of 48212, 17 and 19.

EXERCISE XXVII.

- | | |
|---------------------------|-----------------------------|
| (1) 438592×17 | (11) 287546×15 |
| (2) 6017839×16 | (12) 7863521×18 |
| (3) 60857410×15 | (13) 23781×14 |
| (4) 79845103×18 | (14) 4236541×17 |
| (5) 142587623×13 | (15) 1835429×13 |
| (6) 98043527×14 | (16) 987654×16 |
| (7) 3260625×16 | (17) 320070×1400 |
| (8) 54370650×19 | (18) 100936×17000 |
| (9) 58472×13 | (19) 10608000×1300 |
| (10) 8345620×17 | (20) 234500×16000 |

EXERCISE XXVIII.

- | | |
|------------------------------|--|
| (1) 7563124×101 | (11) 58432631×108 |
| (2) 56342901×1001 | (12) 857320507×1005 |
| (3) 290076358×10001 | (13) 25603054×1008 |
| (4) 624345×102 | (14) 8946237×19 |
| (5) 82654352×103 | (15) 8946237×109 |
| (6) 9432654×107 | (16) 8946237×1009 |
| (7) 20560078×1007 | (17) 27438956×106 |
| (8) 254836241×104 | (18) 537609000×1020 |
| (9) 58364212×111 | (19) $29330 \times 170 \times 1070 \times 10070$ |
| (10) 246314×1011 | (20) 358740100×10800 |

EXERCISE XXIX.

- | | |
|---------------------------|------------------------------|
| (1) 52019763×21 | (11) 12468000×71000 |
| (2) 68320094×31 | (12) 48760200×3160 |
| (3) 4107618×41 | (13) 27341×71 |
| (4) 5090090×51 | (14) 27341×17 |
| (5) 16487312×61 | (15) 376859×31 |
| (6) 43506×71 | (16) 376859×13 |
| (7) 728943×81 | (17) 419068×15 |
| (8) 19312650×91 | (18) 419068×51 |
| (9) 32863400×610 | (19) 206867×41 |
| (10) 52900×4100 | (20) 206867×14 |

EXERCISE XXX.

- | | |
|-----------------------|-----------------------|
| (1) 35943628 × 201 | (11) 325408600 × 810 |
| (2) 9016706 × 301 | (12) 325408600 × 180 |
| (3) 11043690 × 401 | (13) 104578000 × 901 |
| (4) 763005090 × 501 | (14) 104578000 × 1090 |
| (5) 2109863 × 6001 | (15) 478006043 × 17 |
| (6) 2109863 × 601 | (16) 478006043 × 71 |
| (7) 2109863 × 61 | (17) 478006043 × 701 |
| (8) 21098630 × 60001 | (18) 478006043 × 107 |
| (9) 475328956 × 7010 | (19) 478006043 × 1007 |
| (10) 325408600 × 8010 | (20) 478006043 × 7001 |

EXERCISE XXXI.

- | | |
|----------------------|----------------------------|
| (1) 48927653 × 742 | (11) 15827632 × 780130 |
| (2) 48927653 × 427 | (12) 243598000 × 1909500 |
| (3) 1093856 × 545 | (13) 357823492 × 50350 |
| (4) 3256740 × 5450 | (14) 4768923150 × 720900 |
| (5) 18094300 × 8240 | (15) 329616000 × 17068 |
| (6) 4760095 × 248 | (16) 52631578967 × 680017 |
| (7) 37823500 × 76300 | (17) 89777630050 × 816 |
| (8) 42050000 × 6370 | (18) 57234000905 × 954 |
| (9) 517328645 × 1872 | (19) 853011009375 × 107214 |
| (10) 4072908 × 5614 | (20) 46371968750 × 16480 |

EXERCISE XXXII.

Work Exercise VII, using the new wording.

EXERCISE XXXIII.

- | | |
|-----------------------|-----------------------|
| (1) From 5019308 take | (2) From 3785926 take |
| 62412 | 408620 |
| 127842 | 7053 |
| 5708 | 12019 |
| 13052 | 38727 |
| 58009 | 1968 |
| 417925 | 423016 |

(3) From 348009052 take

7016094

14802060

24768923

5600082

28004015

13017019

(4) From 18050000 take

857142

857142

857142

857142

857142

(5) From 7009013 take

68459

194360

4011318

604098

28943

173666

(6) From 53685947 take

6078254

6078254

6078254

6078254

6078254

6078254

(7) From 5000000 take

18049

7683

354975

867324

841825

1019078

(8) From 10000000 take

345978

345978

345978

345978

345978

345978

345978

345978

(9) From 62947 take

6083

7509

1234

8765

9012

10010

(10) From 17685924 take

946877

946877

946877

946877

946877

946877

946877

946877

946877

EXERCISE XXXVIII.

- (1) $3257968 \div 10, 100, 1000, 10000.$
- (2) $\text{£}8684. 7s. 6d. \div 10, 100, 1000, 10000.$
- (3) $\text{£}39791. 13s. 4d. \div 10, 100, 1000, 10000, 100000.$
- (4) $\text{£}243519. 16s. 5d. \div 1000.$
- (5) $\text{£}4000019. 6s. \div 10000.$
- (6) $\text{£}59. 9s. 7d. \div 100.$

EXERCISE XXXIX.

- | | |
|--|---|
| (1) $458239 \div 14$ | (7) $14685999 \div 49$ |
| (2) $\text{£}670138. 12s. 11d. \div 66$ | (8) $\text{£}27632. 4s. 3\frac{1}{2}d. \div 64$ |
| (3) $826549 \div 45$ | (9) $7632419 \div 77$ |
| (4) $\text{£}764. 18s. 2\frac{3}{4}d. \div 72$ | (10) $\text{£}1000000 \div 84$ |
| (5) $2761324 \div 81$ | (11) $5768341 \div 132$ |
| (6) $\text{£}5374. 17s. 6d. \div 15$ | (12) $\text{£}16349. 12s. 7d. \div 42$ |

EXERCISE XL.

- | | |
|-------------------------------|-----------------------------------|
| (1) $315672 \div 20$ | (14) $34603421 \div 7410000$ |
| (2) $8409136 \div 30$ | (15) $368254000 \div 5300000$ |
| (3) $8409136 \div 40$ | (16) $1498632000 \div 730$ |
| (4) $8409136 \div 50$ | (17) $7765450000 \div 38500$ |
| (5) $437589601 \div 90$ | (18) $36932215800000 \div 738600$ |
| (6) $8392 \div 60$ | (19) $487563625 \div 50$ |
| (7) $595536900 \div 70$ | (20) $487563625 \div 500$ |
| (8) $2359360 \div 80$ | (21) $487563625 \div 5000$ |
| (9) $904813 \div 600$ | (22) $487563625 \div 50000$ |
| (10) $5897343 \div 5000$ | (23) $4875636250 \div 50000$ |
| (11) $388493200 \div 9000000$ | (24) $48756362500 \div 50000$ |
| (12) $3596250000 \div 5000$ | (25) $487563625000 \div 50000$ |
| (13) $57892517 \div 63200$ | |

EXERCISE XLI.

- | | |
|-------------------------|--|
| (1) 381961×25 | (9) 385149×625 |
| (2) 621852×75 | (10) 103416×75 |
| (3) 776877×125 | (11) 94238×375 |
| (4) 492743×375 | (12) 723498×875 |
| (5) 276768×625 | (13) $427 \times 25 \times 25 \times 25$ |
| (6) 512634×875 | (14) $1853 \times 125 \times 25 \times 875$ |
| (7) 85059×125 | (15) $1866 \times 375 \times 5 \times 75 \times 1000$ |
| (8) 52530×25 | (16) $512 \times 125 \times 375 \times 625 \times 875$ |

EXERCISE XLII.

- (1) Add in the binary scale, 111, 1100, 1101, 1110, 11001, 1001, 11101.
- (2) In the ternary scale, 1220, 2012, 2111, 210, 12112, 222, 1221.
- (3) In the quaternary scale, 1032, 1222, 22321, 1211, 1002, 12223, 3232.
- (4) In the quinary scale, 2341, 1234, 110, 2323, 443322, 12340, 342103.
- (5) In the senary scale, 54320, 234, 5030, 24110, 25142, 33445, 55443.
- (6) In the septenary scale, 6543, 6321, 1324, 235, 35264, 10235.
- (7) In the octonary scale, 76321, 4623, 5276, 35402, 70607, 42354.
- (8) In the nonary scale, 1235, 7834, 72684, 503785, 123456, 78064.
- (9) In the undecimal scale (using *t* for ten), 6*t*432, 12579, 708*t*4, 5*tt*37*t*.
- (10) In the duodecimal scale (using *t* for ten and *e* for eleven), 6*te*4*e*, 7*ee**t*4, 897*e*5, 3364*t*, *tetet*, *eeee*.
- (11) In each of the preceding scales, 11111 + 10101 + 11001 + 10011 + 11001 + 10111 + 1111 + 1001 + 11001 + 1 + 111 + 101.

EXERCISE XLIII.

- (1) Take in the binary scale, 101010 from 1110101.
- (2) In the ternary scale, 211021 from 1002101.
- (3) In the quaternary scale, 121323 from 303030.
- (4) In the quinary scale, 32402 from 40000.
- (5) In the senary scale, 12345 from 323520.
- (6) In the septenary scale, 135066 from 423450.
- (7) In the octonary scale, 3407427 from 7262520.
- (8) In the nonary scale, 326784 from 2233441.
- (9) In the undecimal scale, $7t4t3$ from 102030.
- (10) In the duodecimal scale, $7teet407$ from $89t4007te$.
- (11) In each of the preceding scales, 101101011 from 110010010.

EXERCISE XLIV.

- (1) 1011101×10011 in the binary scale.
- (2) 2122002×1212 in the ternary scale.
- (3) 3130321×30012 in the quaternary scale.
- (4) 123404×3204 in the quinary scale.
- (5) 53210×1305 in the senary scale.
- (6) 130666×651 in the septenary scale.
- (7) 46734×730 in the octonary scale.
- (8) 80600×71000 in the nonary scale.
- (9) $457t \times 4tt1$ in the undecimal scale.
- (10) $6et1 \times 6et1$ in the duodecimal scale.
- (11) 1100×1000 in every scale.

EXERCISE XLV.

- (1) $1000110 \div 1000$ in the binary scale.
- (2) $12112 \div 2$ in the ternary scale.
- (3) $321232 \div 3$ in the quaternary scale.
- (4) $100342 \div 3$ in the quinary scale.
- (5) $132432 \div 7$ in the senary scale.
- (6) $543212 \div 4$ in the septenary scale.
- (7) $5372461 \div 7$ in the octonary scale.
- (8) $33776426 \div 6$ in the nonary scale.

- (9) $123456 \div t$ in the undecimal scale.
 (10) $5732te2 \div t$ in the duodecimal scale.

EXERCISE XLVI.

- (1) Express 1024* in the binary scale.
 (2) Express 719 in the binary scale.
 (3) Express 719 in the ternary scale.
 (4) Express 1000 in the quaternary scale.
 (5) Express 760 in each scale from the binary to the duodecimal scale.
 (6) Express 20453 in the same scales.
 (7) Convert 3742 (nonary) to the decimal scale.
 (8) Convert 51342 (senary) to the decimal scale.
 (9) 123402 (quinary) to the decimal scale.
 (10) 45312 (septenary) to the decimal scale.
 (11) 10111001 (binary) to the decimal scale.
 (12) $4eete3$ (duodecimal) to the decimal scale.
 (13) Convert 11001 (binary) to the quinary scale.
 (14) 31426 (octonary) to the septenary scale.
 (15) 12121210 (ternary) to the quaternary scale.
 (16) $5t31t9$ (undecimal) to the nonary scale.
 (17) $te3418$ (duodecimal) to the octonary scale.
 (18) 100000000 (binary) to each of the other scales.

EXERCISE XLVII.

- (1) Reduce 1000000 farthings to £. s. d.
 (2) Find the value of a million penny postage-stamps.
 (3) Reduce 987654321 farthings to £. s. d.
 (4) Reduce 2479 sixpences to £. s. d.
 (5) Reduce 2573 half-crowns to £. s. d. (N.B. 8 half-crowns = £1.)
 (6) Reduce 17019 fourpenny-pieces to £. s. d.
 (7) Reduce to £. s. d. the following :
- | | |
|----------------------|----------------------|
| 1. 43794 farthings. | 4. 111840 farthings. |
| 2. 47901 farthings. | 5. 197311 halfpence. |
| 3. 637425 farthings. | 6. 16049 pence. |

* Where no scale is specified, the decimal scale is understood.

EXERCISE XLVIII.

- (1) Reduce 79 inches to feet.
- (2) „ 159 inches to yards, &c.
- (3) „ 1000 inches to fathoms (1 fathom = 6 feet).
- (4) „ 5000 yards to miles.
- (5) 1. Reduce 5317 inches to yards.
 2. „ 16029 „ „
 3. „ 867 „ „
 4. „ 1868 „ „
 5. „ 4428 „ „
 6. „ 2340 „ „
- (6) 1. Reduce 176000 yards to miles.
 2. „ 1000000 „ „
 3. „ 74912 „ „
 4. „ 16016 „ „
- (7) Reduce 500497056 inches to miles, &c.

EXERCISE XLIX.

- (1) Reduce 7843 links to chains.
- (2) „ 53984 links to miles.
- (3) „ 174986 links to miles.
- (4) „ 1000000 links to miles.

EXERCISE L.

- (1) Reduce 243 nails to yards.
- (2) „ 587 „ „
- (3) „ 1024 „ „

EXERCISE LI.

- (1) Reduce 5317 pints to gallons.
- (2) „ 20000 gills to gallons.
- (3) „ 3719 quarts to gallons.

EXERCISE LII.

- (1) Reduce 1700 gallons to quarters.
- (2) „ 1359 „ „
- (3) „ 1000000 „ „

EXERCISE LIII.

- (1) Reduce 1750 sheets to reams.
- (2) „ 157 quires to reams.
- (3) „ 1920 sheets to reams.

EXERCISE LIV.

Reduce :

- (1) 1250 drams to ounces.
- (2) 512 drams to ounces.
- (3) 10000 drams to lbs.
- (4) 2055 drams to lbs.
- (5) 5040 lbs. to cwts.

Reduce :

- (6) 11111 lbs. to cwts.
- (7) 100000 lbs. to tons.
- (8) 25200 lbs. to tons.
- (9) 1000 cwts. to tons.
- (10) 27419 lbs. to tons.

EXERCISE LV.

- (1) Reduce 500 grains to dwts.
- (2) „ 5760 grains to lbs.
- (3) „ 7000 grains to lbs.
- (4) „ 157409 grains to lbs.

EXERCISE LVI.

- (1) Reduce 7 yds., 2 ft., 9 in., to inches.
- (2) „ 3 m., 1 fur., 93 yds., to feet.
- (3) „ £73. 14s. 7½d. to farthings.
- (4) „ £100 to sixpences.
- (5) „ 6s. 8d. to fourpenny-pieces.
- (6) „ 5 half-crowns to threepenny-pieces.
- (7) „ £7. 17s. 6d. to sixpences.
- (8) „ £99. 19s. 11¾d. to farthings.
- (9) „ £19. 15s. to crowns.
- (10) „ £52. 10s. to half-crowns.
- (11) „ £6. 13s. 7½d. to halfpence.
- (12) „ £18. 2s. 9½d. to farthings.
- (13) „ 100 tons to lbs.
- (14) „ 8 cwt., 11 oz., to oz.
- (15) „ 5 reams to sheets.
- (16) „ 1 year to seconds.
- (17) How many beats does the seconds' pendulum make in a week ?
- (18) How many miles can I travel for £3. 7s. 10d. at a penny a mile ?

EXERCISE LVII.

(1) Add 50 tons, 17 cwt., 3 qrs., 15 lbs. ; 12 tons, 12 cwt., 12 lbs. ; 25 tons, 11 cwt., 7 lbs. ; 33 tons, 15 cwt., 2 qrs., 23 lbs.

(2) Add 5 oz., 13 dwt., 7 grs. ; 11 oz., 10 dwt., 17 grs. ; 2 oz., 15 grs. ; 17 dwt., 14 grs. ; 3 oz., 23 grs.

(3) 5 miles, 7 fur., 13 yds. + 19 miles, 1 fur., 200 yds. + 11 miles, 3 fur., 37 yds. + 2 fur., 183 yds. + 17 miles, 5 fur., 177 yds.

(4) 24 hrs., 11 min., 25 sec. + 19 hrs., 17 min., 11 sec. + 1 hr., 49 min., 50 sec. + 20 hrs., 20 min., 20 sec.

(5) 13 tons, 17 cwt., 13 lbs. - 4 tons, 15 cwt., 3 qrs., 20 lbs.

(6) 9 oz., 3 dwt., 3 grs. - 3 oz., 13 dwt., 7 grs.

(7) 20 miles - 11 miles, 1 fur., 17 yds.

(8) From 7 yds., 11 inches, take 3 yds., 2 feet, 7 inches.

(9) 8 tons, 11 cwt., 1 qr., 14 lbs. \times 308.

(10) 5 oz., 5 dwt., 17 grs. \times 3160.

(11) 5 miles, 155 yds. \times 188.

(12) 237 tons, 18 cwt., 3 qrs., 20 lbs. \div 4 cwt., 3 qrs., 1 lb.

(13) 20 lbs. troy \div 15 dwt., 11 grs.

(14) 7 tons, 11 cwt., 14 lbs. \div 7.

(15) 13 lbs. troy \div 32.

(16) 173 tons, 5 cwt., 1 qr., 3 lbs. \div 19.

(17) 24 miles \div 55.

(18) 186 yds., 11 inches \div 89.

(19) $360^\circ \div 365$.

(20) How many copies can be printed off 13 reams, 7 quires, each consisting of 11 sheets?

EXERCISE LVIII.

Find all measures of 10, 12, 16, 20, 36, 60, 100, 112, 120, 144, 240, 360, 960, 1000, 1760, 5760, 7000.

EXERCISE LIX.

(1) Write out all the prime numbers under 100.

(2) Classify the following numbers into prime and composite numbers : 91, 111, 113, 117, 119, 121, 131, 133.

EXERCISE LX.

Determine by inspection the measures under 13 of the following numbers: 504, 405, 315, 168, 451, 512, 98, 1080, 9999, 864, 1296, 6144, 7020, 7040, 33264, 142857, 999999, 2520.

[EXERCISE LXI.

By what numbers not exceeding the radix are the following divisible?

- (1) 23054, 12304, 5523 (senary).
- (2) 112235, 16245, 43700 (octonary).
- (3) 444444, 52836, 58780 (nonary).
- (4) 7347t2, tteet, 486310 (duodecimal).]

EXERCISE LXII.

Resolve into prime factors :

(1) 6	(6) 40	(11) 240	(16) 5760
(2) 8	(7) 91	(12) 720	(17) 7000
(3) 15	(8) 96	(13) 1320	(18) 8140
(4) 16	(9) 120	(14) 1760	(19) 8712
(5) 36	(10) 143	(15) 1845	(20) 1848

EXERCISE LXIII.

Classify the following numbers into prime and composite, and resolve each composite number into its prime factors: 101, 765, 169, 247, 2109, 365, 1367, 1867, 4019, 3059, 483, 99, 999, 9999, 99999, 999999.

EXERCISE LXIV.

Find G.C.M. of :

(1) 84 and 96	(7) 28 and 49
(2) 48 and 144	(8) 141 and 74
(3) 32 and 60	(9) 28 and 42
(4) 45 and 28	(10) 66 and 99
(5) 120 and 150	(11) 100 and 175
(6) 38 and 57	(12) 180 and 240

EXERCISE LXV.

Find g.c.m. of :

- | | |
|-------------------|--------------------|
| (1) 512 and 240 | (7) 840 and 1440 |
| (2) 1760 and 990 | (8) 360 and 900 |
| (3) 5760 and 7000 | (9) 2100 and 2240 |
| (4) 212 and 504 | (10) 210 and 1008 |
| (5) 112 and 28 | (11) 1485 and 2160 |
| (6) 77 and 231 | (12) 7040 and 7392 |

EXERCISE LXVI.

Find g.c.m. of :

- | | |
|-----------------------|------------------------|
| (1) 2536 and 3487 | (11) 78473 and 94653 |
| (2) 2479 and 3589 | (12) 2760 and 4485 |
| (3) 3045 and 6195 | (13) 1177 and 2675 |
| (4) 8823 and 11937 | (14) 14141 and 16289 |
| (5) 568 and 712 | (15) 85359 and 86128 |
| (6) 419 and 52301 | (16) 44323 and 61087 |
| (7) 11023 and 6493 | (17) 17596 and 26145 |
| (8) 27671 and 408870 | (18) 1485 and 2160 |
| (9) 35143 and 10283 | (19) 7040 and 7392 |
| (10) 232353 and 39699 | (20) 999999 and 571428 |

EXERCISE LXVII.

Find g.c.m. of :

- | | |
|---------------------|------------------------|
| (1) 1679 and 1932 | (9) 2268 and 3348 |
| (2) 1003 and 2419 | (10) 1189 and 2146 |
| (3) 33853 and 35017 | (11) 94653 and 78473 |
| (4) 533 and 1189 | (12) 2993 and 3869 |
| (5) 33787 and 34691 | (13) 768 and 16777216 |
| (6) 11009 and 12827 | (14) 5115 and 7254 |
| (7) 4189 and 4307 | (15) 324 and 456 |
| (8) 4489 and 5293 | (16) 269178 and 352002 |

EXERCISE LXVIII.

- (1) Find G.C.M. of 12, 24, 36.
 (2) " 2255, 4305, 6355, 9020, 10455.
 (3) " 68, 17, 102, 34.
 (4) " 909, 1414, 2323, 4242, 2121.
 (5) " 1521, 585, 4095, 3393, 10764, 4563.
 (6) " 132288, 107328, 138216, 97344.
 (7) " 740, 333, 296.
 (8) Find the largest number of which the following are multiples :
 833, 1785, 1309.
 (9) An exact number of shares, all at the same price, was bought
 with each of the following sums : £87. 6s. 3d., £134. 18s. 9d.,
 £341. 6s. 3d. Find the highest possible price of each share.
 (10) Two distances of 901 and 1037 miles respectively are por-
 tioned off into equal daily journeys. Find the smallest number of
 days in which the journeys can be accomplished.
 (11) A court 6 yds., 2 ft., 7 in. long, and 5 yds., 2 ft., 5 in.
 broad, is to be paved with *square* tiles. Find the largest possible
 size of the tiles, and how many are required.

Find L.C.M. of :

EXERCISE LXIX.

- | | | |
|-------------|--------------|--------------|
| (1) 5 and 6 | (3) 6 and 11 | (5) 9 and 10 |
| (2) 5 and 9 | (4) 7 and 3 | (6) 2 and 3 |

Find L.C.M. of :

EXERCISE LXX.

- | | |
|-------------------|--------------------|
| (1) 60 and 90 | (11) 345 and 346 |
| (2) 75 and 100 | (12) 960 and 1000 |
| (3) 80 and 105 | (13) 180 and 150 |
| (4) 25 and 75 | (14) 801 and 890 |
| (5) 25 and 21 | (15) 555 and 370 |
| (6) 13 and 12 | (16) 120 and 320 |
| (7) 365 and 657 | (17) 424 and 583 |
| (8) 5000 and 6000 | (18) 319 and 407 |
| (9) 25 and 30 | (19) 1679 and 1932 |
| (10) 345 and 690 | (20) 1003 and 2419 |

Find L.C.M. of :

EXERCISE LXXI.

- | | |
|---------------------------|-------------------------------|
| (1) 2, 3, 5, 7 | (7) 7, 14, 15, 21, 45 |
| (2) 2, 3, 6 | (8) 30, 40, 50, 60 |
| (3) 3, 5, 9, 25 | (9) 16, 25, 81 |
| (4) 3, 5, 15, 9, 25 | (10) 80, 200, 45, 72, 225, 48 |
| (5) 6, 60, 12, 15, 20, 30 | (11) 98, 35, 77, 121 |
| (6) 4, 8, 12, 16, 20 | (12) 26, 39, 52, 65 |

Find L.C.M. of :

EXERCISE LXXII.

- | | |
|--|---|
| (1) 24, 20, 18, 16, 12, 15 | (11) 105, 120, 616, 88, 24,
12, 6, 308 |
| (2) 18, 36, 24, 35, 20 | (12) 12, 18, 27, 63, 28 |
| (3) 6, 10, 14, 15, 21, 35 | (13) 7, 11, 4, 14, 10, 5, 15 |
| (4) 30, 42, 105, 70 | (14) 323, 247, 209, 133 |
| (5) 12, 20, 28, 18, 30, 42, 45,
63, 105, 70 | (15) 6, 5, 3, 11, 35, 44, 68,
17, 14 |
| (6) 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12 | (16) 1003, 1357 |
| (7) 21, 15, 33, 35, 77, 105,
165, 385, 231 | (17) 899, 961 |
| (8) 16, 6, 8, 2, 12, 3, 48, 24 | (18) 407, 703, 444 |
| (9) 34, 26, 65, 85, 51, 39 | (19) 411, 959, 2055 |
| (10) 10, 20, 30, 40, 50, 60 | (20) 120, 400, 500, 375, 1500,
1000, 960 |

(21) Three travellers journey 15, 18 and 24 miles a-day respectively. How far off is the first station at which all three put up ?

(22) If the year of the planet Mercury were exactly 87, that of Venus 225, and of the earth 365 of our days ; how many of our years would intervene between any two occasions on which the three planets would appear to a spectator from the sun to be in a straight line ?

(23) If there be a house-door every 21 yds., and a lamp-post every 44 yds., 1 ft. ; supposing a lamp-post exactly opposite one house-door, at what distance will the same occur again, and how many houses and lamp-posts will intervene ?

EXERCISE LXXIII.

(1) Of the following pairs of numbers, find the G.C.M., the L.C.M., and the least number by which each must be multiplied to yield a multiple of the other.

- | | |
|--------------------------|--------------------------|
| <i>a.</i> 600 and 480. | <i>d.</i> 1109 and 1867. |
| <i>b.</i> 1564 and 1932. | <i>e.</i> 500 and 729. |
| <i>c.</i> 2530 and 1760. | <i>f.</i> 2574 and 3336. |

(2) What is the smallest sum of money that can be expressed, either

- a.* as guineas or pounds ;
- b.* as crowns or half-guineas ;
- c.* as a multiple of 15*s.* 9*d.* or of 17*s.* 6*d.* ?

(3) Find the smallest weight which can be expressed by an exact number either of lbs. troy or lbs. avoirdupois.

(4) If 1 lb. of sugar is worth 5½*d.*, and 1 lb. of coffee, 1*s.* 2*d.* ; find the smallest number of lbs. of coffee which is worth an exact number of lbs. of sugar.

(5) Find the value of the smallest number of lbs. of coffee at 1*s.* 3*d.* that can be exchanged for an exact number of lbs. of tea at 2*s.* 9*d.* each.

(6) Of two cog-wheels with 75 and 120 teeth respectively, a particular tooth of the smaller wheel comes in contact with a tooth of the larger. In how many turns of each wheel will these two teeth meet again, and how many contacts will there have been ?

EXERCISE LXXIV.

Mix (using the least number of the smallest units given in each component) :

- | | | |
|--|---|-------------------------------------|
| (1) lbs. at 5½ <i>d.</i> | with lbs. at 3 <i>d.</i> | to yield lbs. at 4 <i>d.</i> |
| (2) lbs. at 1 <i>s.</i> 8 <i>d.</i> | „ lbs. at 2 <i>s.</i> 1 <i>d.</i> | „ lbs. at 1 <i>s.</i> 10½ <i>d.</i> |
| (3) lbs. at 3 <i>s.</i> 4½ <i>d.</i> | „ lbs. at 1 <i>s.</i> 10½ <i>d.</i> | „ lbs. at 2 <i>s.</i> 3 <i>d.</i> |
| (4) Casks at £1. 3 <i>s.</i> 9¾ <i>d.</i> | „ casks at 14 <i>s.</i> 9¾ <i>d.</i> | „ casks at £1. 1 <i>s.</i> |
| (5) Tons at £15. 2 <i>s.</i> 6 <i>d.</i> | „ cwts. at £1. 11 <i>s.</i> 3 <i>d.</i> | „ cwts. at £1. |
| (6) lbs. at 5½ <i>d.</i> | „ lbs. at 1 <i>s.</i> 2¼ <i>d.</i> | „ lbs. to be sold at |
| 1 <i>s.</i> per lb., making a profit of 2¾ <i>d.</i> per lb. | | |

(7) A has to travel 1800 miles in Tartary. On foot he can travel 16 miles a day, on horseback 40 miles a day. For how many days can he afford to walk so as to complete his journey in 75 days?

(8) Mix gallons of spirits at 26s. 3d. per gallon with water, so as to sell the mixture at 18s. per gallon.

(9) Mix gallons of spirits at £1. 1s. 3d. per gallon with water, so as to sell the mixture for 12s. 8d. per gallon, and make a profit of 2s. 8d. per gallon.

MISCELLANEOUS EXAMPLES.

1. (1) If 4 articles cost £5. 7s. 8d., what will a dozen cost?
- (2) If 6 articles cost 17s. 3½d., what will 30 cost?
- (3) If 20 men can do a piece of work in 17 days, how long will 4 men take?
- (4) If 7 silk handkerchiefs cost £1. 8s. 10½d., what will 91 cost?
- (5) If a dozen of wine cost £2. 2s., what will 3 bottles cost?
- (6) If 28 lbs. cost £7. 17s. 6d., what will 4 lbs. cost?
- (7) Find the cost of 5 articles at £6. 6s. 8d. per score.
- (8) If 17 articles cost £3. 18s. 7½d., what will 1 cost?
- (9) Find the cost of 15 articles, if 8 cost £1. 7s. 4d. [Here first find the cost of 1 article and thence of 15.]
- (10) Find the cost of 35 articles, if 15 cost £7. 4s. 5¼d. [15 and 35 not being prime to one another (g.c.m. 5), it is shorter and easier to find the value of 5, and thence of 35.]
- (11) If the provisions of a fortress will last 60 days, allowing each man 24 oz. per day, how long will the provisions last, if the allowance is reduced to 15 oz.?
- (12) And what may be the daily allowance, for the fortress to hold out 144 days?
- (13) Find the cost of 9 articles, if 8 cost £17. 4s. 10d.
- (14) Find the cost of 25 articles, if 45 cost £3. 10s. 3¾d.
- (15) If 1 cwt. cost £30, what will 77 lbs. cost?
- (16) If 1 ton cost £8. 8s. 4d., what will 12 cwt. cost?

(17) If for 20 shillings I can travel 150 miles, how far shall I be able to travel for 12s.?

(18) If 2 tons, 5 cwt. cost £23. 12s. 6d., what will 1 ton, 5 cwt. cost?

(19) If in 1 year, 8 months, I put by £45, how much shall I put by in $2\frac{1}{2}$ years?

(20) If 1 cwt., 2 qrs., 12 lbs. cost £3. 15s. 9d., what will 1 cwt., 3 qrs., 4 lbs. cost?

Simplify :

2. BRACKETS.

- (1) $(8 + 3) \times 5 + 10$
- (2) $(145 + 29 + 10) \times 6 + 100$
- (3) $(2519 - 728) \times 45 + 512$
- (4) $2519 \times 45 - 728 \times 45 + 512$
- (5) $(358 + 119) \times 7 + 99$
- (6) $99 + (119 + 358) \times 7$
- (7) $99 + 119 + 358 \times 7$
- (8) $(99 + 119 + 358) \times 7$
- (9) $99 \times 7 + 119 \times 7 + 358 \times 7$
- (10) $67 \times 19 + 25$
- (11) $(67 + 25) \times 19$
- (12) $67 \times 19 + 67 \times 8$
- (13) $67 \times (19 + 8)$
- (14) $48520 \times 1976 + 48520 \times 1090$
- (15) $48520 \times (1976 + 1090)$
- (16) $(58512 + 7426) + (58512 - 7426)$
- (17) $(58512 + 7426) - (58512 - 7426)$

[Note that to (16) the answer is twice the greater number, and to (17) twice the less. Why?]

- (18) $758 \times 758 - 757 \times 757$
- (19) $(125796 + 18043 + 237509 + 2759286) \div 602$
- (20) $(106033 + 112568) \div (45 + 62)$
- (21) $(106033 + 112568) \div (437 + 598 + 612 + 396)$
- (22) $(436 \times 436 - 157 \times 157) \div (436 - 157)$
- (23) $(8424 \times 7056 \times 102) \div 9072$
- (24) $(3492 \times 2049 \times 867) \div 15606$

- (25) $(34936 \times 816 \times 2046) \div 209616$
 (26) $(£1. 12s. 8\frac{1}{2}d. \times 63 \times 112) \div £1. 1s. 9\frac{1}{2}d.$
 (27) $(£1. 12s. 8\frac{1}{2}d. \times 63 \times 112) \div 392$
 (28) $(£597. 13s. 11d. \times 845) - (£597. 13s. 11d. \times 843)$
 (29) $28519 \times 63 - 28519 \times 53$
 (30) $62743 \times 1509 - 62740 \times 1509$
 (31) $(14688 \times 1045 \times 10110) \div 108851$
 (32) $(812345 + 109876 + 234567 + 321098 + 456789 + 159576)$
 $\div (3257 \times 643)$
 (33) $£14. 7s. 3\frac{3}{4}d. \times 79 + £14. 7s. 3\frac{3}{4}d. \times 21$

3. (1) London contains 400778 houses, each inhabited by 8 persons on an average. Find the total number of inhabitants.

(2) The water-works of London supply 26 gallons a-day for each person. How much is supplied in a year to all London?

(3) How much will this water weigh, at 10 lbs. per gallon?

(4) In 1868 the births were in London 115744, and the deaths 74908. What was the increase of the population from this source?

(5) The area of the metropolis is 77997 acres. How many square miles is this? (1 square mile = 640 acres.)

(6) The total revenue of the United Kingdom in 1868 was £71,860,677. 12s. 8d., and the expenditure was £74,082,280. 5s. 5d. Find the deficit.

(7) The different sources of inland revenue yielded in 1868: excise, £20,173,288; stamps, £9,461,010; taxes, £3,450,318; income-tax, £6,184,166. The income from the same sources in 1867 was £39,159,781. Find the increase or decrease.

(8) The income-tax was levied at 6d. in the pound. Find the amount of income taxed.

(9) Divide £15,000 among A, B, C and D, giving to A £1961. 0s. 8d. more than to either of the others, who have equal shares.

(10) At an election, the Liberal candidate obtained 1375 votes more than the Conservative. The total number of votes polled was 7209. How many voted for the Conservative?

(11) A leaves an estate of £100,000, of which he disposes as follows: building lodging-houses, £1750; endowment of parish

school, 1000 guineas ; hospitals, £500 ; to the Church, £500 ; to each of 4 chapels, £125 ; to each of 7 old servants, 19 guineas ; the residue to be divided amongst his family, giving one-third to his widow, one-fourth to his daughter, and the balance in equal shares to his 2 sons. Find their respective shares.

(12) Find the total weekly wages of 325 men, 108 women and 75 children, who receive 4s. 3d., 2s. 10d., 1s. 1d. per day, for each man, woman and child respectively.

(13) A exchanges with B 1 cwt., 11 lbs. of coffee, at $10\frac{1}{2}d.$ per lb., for 5 cwt., 1 qr., 12 lbs. of sugar, at $3\frac{1}{2}d.$ per lb. The difference is to be paid in money. How much is to be paid, and by whom ?

(14) Find the average age of 7 persons, aged respectively 47, 38, 52, 45, 41, 49, 43 years. [An average is the sum of a number of quantities divided by the number of these addenda.]

(15) Find the average height of the following Peaks : Monte Viso, 12580 ft. ; Genève, 11780 ft. ; Cenis, 11457 ft. ; Izéran, 13266 ft. ; M. Blanc, 15732 ft. ; Matterhorn, 14835 ft. ; Rosa, 15150 ft. ; Gallenstock, 12475 ft. ; Vogelberg, 10866 ft. ; Ortlerspitz, 12852 ft. ; Groszglockner, 12776 ft. ; Finster-Aarhorn, 14109 ft. ; Jungfrau, 13176 ft.

(16) A mixes 4 gallons of spirit at 10s. $9\frac{3}{4}d.$, with 6 gallons at 16s. $1\frac{1}{2}d.$, and 5 gallons at 7s. 6d. each. Find the average cost per gallon.

(17) Find the average age of a school in which there are 20 boys at 9 years old, 4 at 10, 10 at 11, 12 at 12, 11 at 13, 2 at 14, and 1 at 15.

(18) A piece of translation consists of 32 pages, averaging 21 lines of 15 words each. What will be the charge at the rate of 3s. 6d. for every 72 words ? Also at the rate of 3s. 6d. for every 96 words ?

(19) I mixed 2 cwt., 2 qrs., 20 lbs., at $6\frac{1}{2}d.$ per lb., with 4 cwt., 2 lbs., at 4d. per lb. Find the price per lb. of the mixture.

(20) What is my income, if at 7d. in the £, I pay £11. 1s. 8d. income-tax ?

(21) $£11. 1s. 8d. \div 7.$

(22) A's income is 500 guineas. What will be left him after paying the income-tax of 5*d.* in the £?

(23) How many times will a coach wheel, of 13 ft., 9 in. in circumference, turn round in going from London to Brighton, 50 miles?

(24) In exchange for 833 articles at 1*s.* 4*d.* each, I gave 39 guineas and 100 articles. What was the cost of each of the latter?

(25) Divide £100. 16*s.* among A, B, C and D, giving to A £10. 10*s.* more than to B, and to B £5. 5*s.* more than to either C or D, who have equal shares.

(26) I spent £97. 1*s.* 8*d.* on equal quantities of three kinds of goods, at 4*s.* 5*d.*, 6*s.* 3*d.* and 8*s.* 9*d.* each article respectively. How many articles did I buy?

(27) Divide £171. 10*s.* among 5 men, 6 women and 7 boys, giving to each woman twice a boy's share, and to each man three times a woman's share.

(28) Bought half a ton of sugar for £15, and sold it at 4½*d.* per lb. Find profit or loss.

(29) Find the least number of rupees at 2*s.* 3*d.* each that shall also be an exact number of rupees at 1*s.* 10½*d.* each.

(30) What is the greatest number by which 7927 and 8773 can be divided, leaving remainders 80 and 100 respectively?

(31) Bought 24 yards of cloth for £4. 3*s.* For how much must the whole be sold to gain 6¾*d.* per yard?

(32) I sold 243 sheep at £2. 7*s.* 6*d.* each, and with the proceeds bought as many oxen at 16½ guineas each as my money would allow. How many oxen did I buy, and what was over?

(33) How many francs at 10*d.* each can I get for £58. 12*s.* 6*d.*?

(34) Find the cost of 1 ton, 5 cwt., 16 lbs., at 3¾*d.* per lb.

(35) A railway, 27 miles in length, is estimated to cost £15000 per mile. How many shares at £25 each must be issued?

(36) Find a number of pounds between £365 and £380, which is also an exact number of guineas.

(37) Find all the sums of money between £280 and £300, which are multiples both of 6*s.* 3*d.* and of 11*s.* 3*d.*

(38) Prove (a) that the G.C.M. of any two numbers can never exceed their difference; (b) that any two consecutive numbers must be prime to each other; (c) that if two numbers are divided by their G.C.M. the quotients are prime to each other; (d) that any number which is divisible by two other numbers will be divisible by their L.C.M.; (e) that one-third of the difference between any number and the sum of its digits is divisible by 3; (f) that every prime number but 2 can be made composite by the addition or subtraction of unity; (g) that every prime number greater than 3 can be made a multiple of 6 either by the addition or else by the subtraction of unity; (h) that any two consecutive odd numbers must be prime to each other.

(39) Express 28437 in the undecimal and duodecimal scales.

(40) If I buy 20 gross of pens at 9d. per dozen, and sell them at 1d. each, what profit do I make?

(41) If I mix 50 gallons of spirit at 14s. 3d. per gallon, with 64 gallons of water, at what price per gallon must I sell the mixture to gain £8. 1s. 6d.?

(42) If my salary is 100 guineas per annum, what should I be paid from June 3rd to October 27th?

(43) If my salary is £300 a-year, how much a-year should I lose by being paid £5. 15s. per week; and how much should I gain by being paid £5. 15s. 6d.?

(44) 33 tons of coals, bought at 23s. per ton, are sold at 1s. 6d. per cwt. Find total profit.

(45) Required the weight of 17 boxes, each weighing 2 cwt., 17 lbs.

(46) How many men would weigh a ton, if they weigh on an average 10 stone (of 14 lbs.) each?

(47) How many fathoms are there in 17 m., 6 fur., 90 yards?

(48) How many weeks have there been from the beginning of the 19th century to January 6th, 1869, counting leap-years?

(49) If I mix of four different drugs, 5 drs., 2 scr., 14 grs.; 1 oz., 3 drs., 2 scr., 17 grs.; 2 oz., 7 drs., 19 grs., and 6 oz., 4 drs. respectively, and make up the mixture into 26 doses, what will each dose weigh?

(50) If I subscribe 3 guineas the first year, and increase my subscription by 10s. 6d. each successive year, how much shall I have given in 10 years?

(51) If I begin with £768. 9s. 9d., and spend each month one-third of what I have at the beginning of that month, what will be left me after 6 months?

(52) If the Liberal majority in 1868 was 65, and in 1869 was 119, how many seats must have been won?

(53) A sovereign weighs 123 grains; how many can be coined out of 41 oz. troy?

(54) What would 21000 sovereigns weigh in avoirdupois weight?

(55) How long would a velocipede take over 50 miles, at the rate of a furlong a minute?

(56) If a box holds 20 bags of corks, each holding a gross, what will 503 boxes cost at $4\frac{1}{2}$ d. per dozen corks?

(57) The four quarters of the year 1869 begin as follows: March 20th, 1 hr., 32 m., p.m.; June 21st, 10 h., 4 m., a.m.; September 23rd, 28 m., a.m.; December 21st, 6 h., 23 m., p.m. Find the lengths of spring, summer and autumn; and taking the year as 365 d., 5 h., 48 m., find the length of winter.

(58) If with $8\frac{1}{2}$ dozen oranges at $1\frac{1}{2}$ d. each, and $31\frac{1}{2}$ lbs. sugar at $5\frac{1}{2}$ d. per lb., I make 45 pots of marmalade, what is the cost per pot?

(59) I spent £291. 5s. on equal quantities of 3 different kinds of goods, costing respectively 13s. 3d., 18s. 9d., £1. 6s. 3d. each article. How many of each kind did I buy?

(60) How many doses of 5 dwt., 8 grs., can be made of 3 lbs. troy?

(61) A dealer bought 560 sheep at £2. 4s. 6d. each, and 320 oxen at £18. 10s. each. He sold 160 sheep at £2. 18s. each, and

the remainder at £2. 5s. each. Of the oxen, he sold 45 at £20 each, and the remainder at $18\frac{1}{2}$ guineas each. His expenses in the transaction were £37. 10s. Did he gain or lose by the transaction, and how much?

(62) Make out a bill for the following purchases :

		<i>s.</i>	<i>d.</i>	
12 lbs. of mutton	@	0	$8\frac{1}{2}$	per lb.
$6\frac{1}{2}$	" "	@	0	9 "
$14\frac{1}{2}$	" beef	@	0	$11\frac{1}{2}$ "
$8\frac{1}{4}$	" "	@	0	8 "
$5\frac{3}{4}$	" pork	@	1	0 "
$10\frac{1}{2}$	" cheese	@	0	$9\frac{1}{2}$ "

(63) Find the cost of constructing a railroad 125 miles long, at the rate of 16 guineas per yard.

(64) What do you understand by the prime factors of a number? How may you determine by the inspection of the digits of a number when it is divisible by the numbers 2, 3 and 11 respectively? Find G.C.M. of 7854 and 9768.

(65) Reduce 167805 lbs. avoirdupois to tons.

(66) Find all the divisors of 2145.

(67) I bought 8027 articles at 5s. $10\frac{1}{4}$ d. each, and sold 4000 articles at 6s. 3d. each. At how much a-piece must I sell the remainder to make a profit of £309. 17s. $7\frac{1}{4}$ d. on the whole?

(68) Explain the terms : Measure, prime numbers, odd numbers, and numbers prime to each other.

(69) What sense, if any, can you attach to the following expressions :

- a. £15. 3s. 8d. + £3. 11s. 9d.
- b. £15. 3s. 8d. - £3. 11s. 9d.
- c. £15. 3s. 8d. × £3. 11s. 9d.
- d. £15. 3s. 8d. ÷ £3. 11s. 9d.
- e. £15. 3s. 8d. × £1.
- f. £15. 3s. 8d. × 0
- g. £15. 3s. 8d. × 1

(70) How many coins, each worth 12s. 7d., must be given in exchange for 143 coins at 16s. $10\frac{1}{2}$ d. each, added to 567 coins at 10s. $1\frac{1}{2}$ d. each?

(71) Find all the common measures of 5082, 9438, 10890 and 8712.

(72) If of a series of quotients obtained by dividing each of a given series of dividends by a common measure, one quotient is prime to any one of the others, the common divisor is the G.C.M. of the series of dividends. Prove it.

(73) If 50 shares are bought at £35. 10s. 6d. each, and sold for £2042. 18s. 4d., what is the gain per share?

(74) A company has 2000 shares of £50 each. It fails, and its debt, £58333. 6s. 8d. must be paid by the shareholders. How much will the holder of 73 shares have to pay, and what will be his total loss if he bought the shares at half-price?

(75) How long would light, which travels from the sun to the earth in 8 minutes, take from the nearest fixed star, which is 200000 times as far as the sun?

(76) A train started from London at 9.15 a.m., and reached Bristol, 120 miles off, at 12.25 p.m.; it stopped at 5 stations, losing 5 minutes at each, with 15 minutes extra at Swindon for refreshment. Find the average rate of the train.

(77) Divide £6842. 14s. 5d. among A, B and C, so that A may have £568. 14s. 4d. more than B, and C £728. 18s. 2d. less than B.

(78) Find G.C.M. of 15 h., 12 min., and 1 d., 3 h., 33 min.

(79) State and prove the test of accuracy by casting out of nines in division.

[(80) Find the criteria of divisibility by 2, 3, 4 and 5 of numbers expressed in the senary scale.

(81) If the number of odd digits in any number expressed in a scale with an odd radix be even, the number is divisible by 2; if not, not.]

(82) Three watches are set together; the first gains 6, the second 8, and the third 10 minutes a-week. In how many weeks will they again shew the same time?

(83) Convert £5013 to guineas, and 5013 guineas to pounds.

(84) Is 1109 a prime number? Describe the shortest way of deciding the question.

(85) Find G.C.M. of 16776 and 2096, and explain each step of the process. Also of 12018, 20030, and 30045.

(86) Define the Least Common Multiple, and find L.C.M. of 85, 125, 1445, 4913.

(87) Find the cost of 4 tons, 13 cwt., 1 qr., 19 lbs., at $2\frac{3}{4}d.$ per lb., and of 2000 oz. troy, at £3. 17s. $10\frac{1}{2}d.$ per oz.

(88) If a certain number of yards at 1s. $1\frac{1}{4}d.$ per yard, and the same number of yards at 1s. $5\frac{1}{2}d.$ per yard, amount together to £515. 1s. 3d., how many yards are there of each?

(89) If 450 articles at £2. 10s. 6d. per article, and a certain number of articles at 5s. $8\frac{1}{2}d.$ each, amount together to £1215. 6s. $2\frac{1}{2}d.$, how many articles of the latter kind are there?

(90) If 45 oxen at £18. 12s. 6d. each, and 75 sheep, together cost £971. 5s., how much does each sheep cost?

(91) A fast train starts $2\frac{1}{2}$ hours after a slow one; in what time will it overtake the latter, their rate being 42 and 30 miles per hour respectively?

(92) A and B start from York and London, travelling 23 miles and 17 miles per hour respectively. In what time will they meet, and what distance from London, the total distance being 200 miles?

(93) A house and its furniture together are worth £2085, the value of the house being 4 times that of the furniture. Find the cost of each.

(94) Find the mean of the following observations: $43^{\circ} 15'$, $48^{\circ} 43'$, $42^{\circ} 17'$, $47^{\circ} 1'$, $50^{\circ} 50'$, $46^{\circ} 19'$, 51° , $44^{\circ} 10'$, $35^{\circ} 12'$, $38^{\circ} 47'$.

(95) Express 4113 (decimal) in the quinary and duodecimal scales.

(96) Convert *tetet* from the duodecimal into the senary scale.

(97) I bought 701 articles for £14493. 3s. 6d., and sold them at a profit of £8. 6s. 6d. each; the total proceeds I invested in some mining shares, each costing £87. 12s. 6d., and yielding £3. 8s. 9d. a-year. Find my total yearly income.

(98) The fore wheel of a carriage is 8 feet, 9 inches in circumference; the hind wheel 14 feet, 7 inches. If a nail on the outside of each wheel touch the ground at starting, how many times in the course of a mile will the same two nails be on the ground together?

(99) At the Crystal Palace were admitted on a Foresters' day 83,500 persons, each paying 1s. How many admissions on a half-crown day would amount to an equal sum?

(100) A person, after paying an income-tax of 5*d.* in the £, has £979. 3*s.* 4*d.* left. Find his gross income.

(101) Reduce to prime factors, 1369.

(102) Express in avoirdupois weight, 320 lb., 10 oz. troy.

(103) Divide the continued product of 5040, 187 and 999, by the continued product of 37, 17 and 42.

(104) Divide the difference between the product of 256 and 278, and the product of 227 and 137, by 17.

(105) Mix spirits at 5*s.* 6*d.* a gallon with spirits at 3*s.* 10*d.* a gallon, so as to produce a quality worth 4*s.* 3*d.* a gallon.

(106) Divide 570021 by 77 by factors, explaining how you obtain the remainder.

(107) I owe a certain sum of money to A, and 3 times as much to B; the two debts, which together amount to £850, I agree to pay off in a year in monthly instalments. How much a month is due to A, and how much to B?

(108) How many gallons at 2*s.* 9*d.* each must be mixed with 100 gallons at 4*s.* 6*d.* each so as to produce a quality worth 3*s.* per gallon?

(109) A and B join in giving a picnic, each paying for the guests he invites. A invites 15 and B 10. The whole cost is £6. 18*s.* 6½*d.* On the day, B pays for the carriages for the whole party at 2*s.* 6*d.* per head, and A pays all the other expenses. How must they afterwards settle accounts with one another?

(110) The circumference of the fore and hind wheels of a carriage are 13 ft., 9 in., and 16 ft., 6 in. respectively. How far has the carriage travelled when the fore wheel has made 768 more revolutions than the hind wheel?

EDISCENDA.

ADDITION.

1. This sign (+) is called *Plus*, and means that the quantities between which it stands are to be added together.

2. The quantities to be added together are called the *Addenda*, and the answer is called the *Sum*.

SUBTRACTION.

3. This sign (−) is called *Minus*, and means that the quantity following it is to be subtracted or taken away from the quantity before it.

4. The quantity from which we subtract is called the *Minuend*; the quantity to be subtracted is called the *Subtrahend*; and the remainder is called the *Difference*.

MULTIPLICATION.

5. *First meaning*: This sign (×) is called *Multiplied by*, and means that the quantity before it is to be *repeated as many times* as is indicated by the number following it.

6. The number or quantity which is to be multiplied is called the *Multiplicand*; the number by which we multiply is called the *Multiplier*; and the result is called the *Product*. The Multiplier and Multiplicand are often also called *Factors* of the Product.

7. *Second meaning*: This sign (×) indicates that the number on either side of it is to be *repeated as many times* as is indicated by the number on the other side of it.

8. *Third meaning*: This sign (×) indicates that the number on either side of it is to be *taken as many times* as is indicated by the number on the other side of it.

DIVISION.

9. *One meaning*: This sign (+) is called *Divided by*, and has the following meaning:—Find *how many times* the quantity following the sign is contained in the quantity preceding the sign, and the answer will be *so many times*.

10. The quantity to be divided is called the *Dividend*; that by which we divide is called the *Divisor*; and the answer is called the *Quotient*; if anything is over it is called the *Remainder*.

11. *Both meanings*: This sign (÷) bears *two* interpretations,—1st, *How many times* is the *quantity* following the sign contained in the quantity preceding the sign, and the answer will be *so many times*; 2nd, *Distribute* the quantity before the sign into as many equal parts as is indicated by the *number* after the sign, and the answer will be *so much to each part*.

MEASURES AND MULTIPLES.

12. If one number can be divided by another number *without remainder*, the Divisor is called a *Measure* of the Dividend, and the Dividend a *Multiple* of the Divisor.

13. A number which has no Measures but itself and unity is called a *Prime Number*; other numbers are called *Composite Numbers*.

14. The Multiples of 2 are called *Even Numbers*; the others are *Odd Numbers*.

15. The Measures that two or more numbers have in common are called their *Common Measures*; and the greatest of these is called their *Greatest Common Measure*, which is indicated by the letters G. C. M.

16. Numbers whose only common measure is unity are said to be *prime to each other*, even though they be not Prime Numbers.

17. The Multiples that two or more numbers have in common are called their *Common Multiples*; and the least of these is called the *Least Common Multiple*, which is indicated by the letters L. C. M.

WEIGHTS AND MEASURES.

MEASURES OF LENGTH AND SURFACE.

Lineal Measure.

12 inches (in.).....	= 1 foot (ft.)
3 feet.....	= 1 yard (yd.)
1 fathom	= 2 yards= 6 feet
5½ yards	= 1 rod or pole (po.)
40 poles, or 220 yards ...	= 1 furlong (fur.)
8 furlongs, or 1760 yards	= 1 mile (m.)

Gunter's Chain (used for Land-measuring).

100 links, 22 yards, or 4 poles.....	= 1 chain (ch.)
484 square yards	= 1 sq. chain
10 sq. chains, or 100,000 sq. links	= 1 acre (ac.)
80 chains	= 1 mile (m.)

Cloth Measure (used by Drapers, Mercers, Clothiers, &c.).

2½ inches (in.) ...	= 1 nail (nl.)
9 „ (4 nails)	= 1 quarter (qr.)
36 „ (4 qrs.)	= 1 yard (yd.)

SQUARE MEASURE.

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet.....	= 1 square yard (sq. yd.)
30½ square yards.....	= 1 square pole (sq. pl.)
40 square poles	= 1 rood (ro.)
4 roods (4840 yards).....	= 1 acre (ac.)
640 acres	= 1 square mile (m.)

MEASURES OF VOLUME.

Solid or Cubic Measure.

1728 cubic inches	= 1 cubic foot (c. ft.)
27 cubic feet...	= 1 cubic yd. (c. yd.)

APOTHECARIES WEIGHT.

20 grains troy	= 1 scruple
3 scruples	= 1 drachm
8 drachms	= 1 ounce (troy)
12 ounces.....	= 1 pound (troy)

WEIGHTS AND MEASURES.

MEASURES OF WEIGHT.

Avoirdupois Weight (used in almost all commercial transactions).

16 drams (dr.).....	= 1 ounce (oz.)
16 ounces... ..	= 1 pound (lb.)=7000 grains
28 lbs.	= 1 quarter (qr.)
4 quarters, or 112 lbs.	= 1 hundred-weight (cwt).
20 hundred-weight.....	= 1 ton (ton)

Troy Weight (used in weighing Gold and Silver, &c.).

24 grains	= 1 pennyweight (dwt.)
20 pennyweights	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.)=5760 grains

MEASURES OF CAPACITY.

Liquid.

4 gills.....	= 1 pint (pt.)
2 pints ...	= 1 quart (qt.)
4 quarts...	= 1 gallon (gal.)

Dry Measure.

2 pints (pts.)	= 1 quart (qt.)
4 quarts.....	= 1 gallon (gal.)
2 gallons ...	= 1 peck (pk.)
4 pecks	= 1 bushel (bus.)
8 bushels ...	= 1 quarter (qr.)
5 quarters...	= 1 load (ld.)

ANGULAR MEASURE.

60 seconds (")	= 1 minute (1')
60 minutes...	= 1 degree (1°)

MEASURES OF TIME.

60 seconds	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (d.)
12 calendar months	= 1 year (yr.)
365 days.....	= 1 year (yr.)

PAPER MEASURE.

24 sheets	= 1 quire (qr.)
20 sheets	= 1 outside quire (out. qr.)
20 quires	= 1 ream (rm.)
10 reams	= 1 bale (bl.)

THE SCIENCE AND ART

OF

ARITHMETIC.

BY A. SONNENSCHNEN AND H. A. NESBITT, M.A.

Part I. Integral. Parts II. & III. Fractional & Approximate Calculations.

OPINIONS OF THE PRESS.

"Mr. Sonnenschein is a pupil, and a thoroughly taught pupil, of Mr. De Morgan's, and it is scarcely necessary to say more in order to convince all who know Mr. De Morgan's works that there is nothing like half-digested work in this arithmetic. This first part of Mr. Sonnenschein's book is admirable of its kind, and better fitted for ordinary school use than Mr. De Morgan's *Arithmetic*, which is more suitable to students and teachers. Brevity and lucidity in the exposition of principle are its main characteristics as a scientific book; and great care in the explanation of simple practical rules for shortening or verifying calculations is its main characteristic in reference to the art of computation. It gives a clear proof of all the rules,—insisting on the exact meaning of the various operations and their interpretation,—and contains a remarkably good chapter on the general properties of numbers, so far as they can be explained to beginners who have only mastered the arithmetic of integers. It is hardly possible to speak too well of this little book, which we have examined very carefully."—*Spectator*.

"... Nor should we notice this lucid and clever work, except with a word of commendation in our short notices, but for the chapter on the ready decimalization of our weights and measures, which is worth the attention of all calculators. . . . Still, it is an ingenious suggestion to decimalize all the different tables of weights and measures by observing the analogies between the relations of those tables and those of the money table, and so making one rule do for all alike. . . . We should add, as we have noticed a particular chapter in this excellent arithmetic, that the book is throughout good, though some portions of it are better adapted for the use of teachers than for the use of pupils. These portions, however, can easily be omitted by the pupil until he is sufficiently advanced. The thoroughness of the methods of proof is exceedingly praiseworthy."—*Spectator*.

"Forty years have elapsed since the appearance of Prof. De Morgan's '*Elements of Arithmetic*,' at a time when perhaps few teachers, as they submitted the rules of the science to their pupils, cared to establish them upon reason and demonstration. The effect of this work was that a rational arithmetic began to be taught generally, and the mere committing of rules to memory took its due subordinate position in the course of instruction. Such a method of treatment will go far to develop and exercise the reasoning powers, and in the case of many pupils, there is hardly any other subject which can so well be made a groundwork for the exercise of the reasoning faculty. The book before us is avowedly drawn up in agreement with the principles of Mr. De Morgan's work, and the aim of the authors is to lead the student 'to the discovery of the several rules by some path such as an original discoverer

OPINIONS OF THE PRESS—continued.

might have travelled.' In this first part, which treats of Integral Arithmetic, we consider that they have carried out their principles successfully, and hope they will succeed as well with the remaining two parts, which are to embrace respectively Vulgar Fractions and Approximate Calculations. The rules enunciated are few and tersely given; there is a great store of illustration; elementary difficulties are well stated and honestly grappled with, and cleared up in a way that brings the subject to the level of the capacities of junior students; at the same time advanced as well as young teachers may gather much that is useful from the book. A reader who has carefully gone through the work, can hardly fail to master the early details of the science; if he fail, it will not be the fault of the authors. The subjects treated of are numeration, modes of computation, the so-called first four rules, contracted operations, scales of notation, and properties of numbers. Under this last division we have much valuable matter grouped under the several heads of Divisibility of Numbers, Casting out Nines, Resolution into Prime Factors, Greatest Common Measure, and Least Common Multiple. Throughout and at the end of the work occur numerous examples, very varied, all of which are carefully arranged, and many fully worked out in two or more ways. With this short analysis of the contents, we heartily commend the work to teachers generally, assuming, of course, that they will regulate their use of it in proportion to the requirements of age and ability of their pupils. The work is neatly got up, and we have detected hardly any errata."—*Nature*.

"The authors of this excellent school arithmetic are to be congratulated on having brought their work to a successful termination. . . . The same good arrangement, ample store of illustration, and copious examples for practice, are to be found in this volume as had place in the first. . . . In this volume we have more advanced subjects treated in like manner. But an analysis of the contents will give a good idea of the work. Under Part II. we have the subject of Vulgar Fractions clearly treated, with applications to Practice, and a chapter which treats of Proportion, the Chain Rule, Compound Proportion, and Proportional Parts. In Part III. are chapters on Converging Fractions, Decimals with their properties, and several applications to Money, Weights, Measures, &c., the Metric System, Progressions, Interest, Discount, Stocks, Evolution, and a good chapter on Arithmetical Complements. There is also a chapter in which we have Continued Product to a given limit, Compound Interest, Equation of Payments, Complex Decimals, Duodecimals, and International Calculations. At the end of the work are given 250 Miscellaneous Exercises. There is enough here to satisfy any youthful arithmetician, and the methods employed are the 'latest out.' The complete work gives ample evidence that it is the composition of men who have given much time and thought to the subject, and have had much tuitional experience."—*Nature*.

"Decidedly the clearest, most useful, and easiest method we have seen of teaching the principles and practices of arithmetic. It combines the excellences of Colenso, De Morgan, and Barnard Smith, with excellences peculiar to itself."—*The Rock*.

"It is a very original and well-reasoned system of educating the mind by means of numbers. The authors, working upon the principle 'that the student must be led to the *discovery* of the several rules by some path such as an original discoverer might have travelled,' have really begun at the beginning and logically deduced one step from another, making all so clear as they proceed, that the merest beginner should understand not merely the 'how' but the 'why.' It is perfectly true that more time and space than some may judge necessary are occupied in presenting what is merely one and the same fact under different aspects, and that what appears to be a complete system of arithmetic may be, and often is, packed into less space than the volume before us, which is but the first of three parts. Those, however, *who have any experience in teaching*, or perhaps remember their own difficulties in

OPINIONS OF THE PRESS—continued.

working by rule of thumb, will entirely agree with the authors that progress is not mere advance from rule to rule. Any process once properly realized can never be quite forgotten, and to impart to students what our authors term 'a thorough and all but visual realization of each process,' should be the aim of every teacher. They can scarcely have a more efficient book to work with than that of Messrs. Sonnenschein and Nesbitt."—*Standard*.

"Some little time ago we drew attention to Part I. of Messrs. Sonnenschein and Nesbitt's Science and Art of Arithmetic. We have now Parts II. and III., dealing with vulgar fractions and approximate calculations, in which again we notice an independence of thought and originality of treatment which go far to shew how little the educational value of arithmetic has hitherto been understood."—*Standard*.

"If we mistake not, Messrs. Sonnenschein and Nesbitt's volume will altogether revolutionize the old methods of teaching what has hitherto been supposed a dry study. It is divided into three parts, viz., 'Integral, Vulgar Fractions, and Approximate Calculations.' New methods are given for very rapid, and in most cases, 'mental,' decimalization of money, weights and measures to any assigned degree of accuracy, and for the ready intro-conversion of the coins, weights, and measures of different nations. The volume must supersede the old-fashioned methods, and will be invaluable to young teachers, as well as learners, and will rapidly make its way as 'the' text-book of arithmetic."—*Naval and Military Gazette*.

"This is a work on Arithmetic of a peculiar, and in some respects an original character. Following in the steps of Professor De Morgan, the chief aim of the authors in explaining the *rationale* of the various arithmetical processes is not to give logical demonstrations of the several rules which a student is required to learn, but to carry him along some such path of reasoning as must have been travelled by an original discoverer; the present concise and conventional processes being unravelled, so to speak, and traced up to their first principles. . . . There is much to recommend in this view of teaching arithmetic; for, as the authors remark in the preface, no subject is so well fitted as this for the early training of the reasoning powers, 'principally because the student is enabled, without apparatus of any kind, steadily to test all his *a priori* conclusions by the light of experience.'"—*Educational Times*.

"This is the second part of a treatise on Arithmetic, the first of which has been already favourably noticed in these columns. The subject of Fractions is here taken up and treated with the fulness and completeness due to the important place it occupies as the Key-stone of Arithmetic. . . . In dealing with Decimals the authors have introduced the principle of 'Approximate Calculations,' by means of which much trouble is saved in working out results. . . . It is here that the great utility and simplicity of Decimals is seen, and the book before us does good service in giving prominence to this feature. . . . We are disposed altogether to entertain a high opinion of the merits of this work. The way in which it leads up to the various rules, by mental calculations and other preparatory steps, which serve to break the difficulty felt by the young learner, and its general adherence throughout to the best principles and methods of teaching, distinguish it as a work out of the common run on treatises of School Arithmetic."—*Educational Times*.

"We have no hesitation in saying that the right note has been struck by the authors of the little book, a second edition of which lies before us. . . . We are happy to conclude with an assurance that, take it as it is, the work of Messrs. Sonnenschein and Nesbitt is the best in the language on the subject of which it treats."—*Inquirer*.

London: WHITTAKER & Co., Ave Maria Lane.

A B C OF ARITHMETIC.

Part I	TEACHERS' BOOK,	1s.;	EXERCISES	only,	4d.
„ II.	ditto	1s.;	ditto		4d.

OPINIONS OF THE PRESS.

“ . . . These books present to the elementary student the subject in such a way that he can deal with it from the very beginning by his own native powers, and lead him to form definitions and rules for himself ; and the inevitable result is that all his notions, as far as they go, are clear, definite and accurate. They must be so, because they are gained by himself, instead of being arbitrarily imposed upon him ; and further because, to use Messrs. Sonnenschein and Nesbitt's own words, ‘ he is led to the discovery of the several rules by some such paths as an original discoverer might have travelled.’ The ‘ A B C ’ of Arithmetic of these authors is in most respects an admirable book of elementary instruction ; . . . a learner by its means will have gained a true insight into the principles of Arithmetic, and have become an apt and intelligent calculator, long before a pupil of the other method has penetrated the bristling palisade of logical definitions, principles and explanations which beset his path.”—*Pall Mall Gazette*.

“ . . . The object of the author and lecturer is carefully to avoid the pupils reasoning out anything which they cannot see. . . . It must have been gratifying to the lecturer, as he carefully and ably unfolded his method to the young people, to find that they thoroughly grasped the system. At the second lecture the higher grades of arithmetical elementary science were touched upon, and the lecturer required his hearers to follow him through some heavy calculations. It was here that the beauty of the number-pictures came out, the scholars giving *viva voce* proof of their power to follow their teacher upon his own system.”—*School Board Chronicle* (1st Notice).

“ . . . Arithmetic taught on this principle is likely to be sound training, even if it has nothing further to recommend it ; but Mr. Sonnenschein is prepared to enforce his plan as the one best calculated to rear facile, clear-headed and accomplished Arithmeticians. . . . The book is for the teacher, who is to carry out the method by the aid of a set of cubes invented by the author. Separate Exercise-books are prepared for the pupils.”—*School Board Chronicle* (2nd Notice).

“ There is a story told of the late Professor de Morgan that, after examining a school in algebra, and even trigonometry, he asked the head class what they understood by the number seven, to which he got no reply, and that thereupon he recommended them to begin their mathematical studies over again. It is certainly not

OPINIONS OF THE PRESS—(continued).

too much to say that no children who had received their first notions of number by the method used by Messrs. Sonnenschein and Nesbitt would have any difficulty in replying to such a question most satisfactorily. . . . In Messrs. Sonnenschein and Nesbitt's method, their physical ten is really ten of their physical units; the hundred, a hundred units; and even the million, really a million units. . . . The fact that there are two kinds of division is strongly brought out in the book, and a new symbol is introduced which means 'is contained in.' . . . The amount of theory taught, almost imperceptibly, by this method is considerable; but still that which is simply useful is aimed at. . . . It will be an evil day for England when instruction is substituted for education, and in no science is this so true as it is in Arithmetic, since Arithmetic is the one single science requiring logical reasoning that is taught to all, young and old, rich and poor, who pretend to any education. No one can doubt that it is very possible to make Arithmetic a mere mechanical operation, and we are very much afraid, from testimony that we get from different directions, that to do otherwise is the exception. We cannot but hope that the adoption of Messrs. Sonnenschein and Nesbitt's method may, to some extent at least, oblige learners to understand what they are doing, on the one hand, and to enable them to talk about the principles and rules, on the other."—*Spectator*.

" . . . The authors of this work, or rather series of works—for they consist of four books, two for the teacher and two for the pupil—are already favourably known by their advanced works on Arithmetic. . . . The principle upon which the authors proceed in teaching the science of number to the infantine mind is that which is universally recognized as the only true one, viz. that of showing by the evidence of the senses that a certain number of given objects—ten balls, for instance—may by separation and re-arrangement be made to exhibit all the different set of numbers, the sum of which is equal to ten. . . . Thus the system of notation, which presents so formidable a difficulty to young children, is, by these concrete quantities, exhibited clearly to the eye and made evident to the senses. We endorse all that the authors advance upon this part of the subject."—*Educational Times*.



